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VOLUME 66 · NUMBER 5 · MAY 1957

Progress Committee Report for 1956

By LLOYD THOMPSON
Committee Chairman

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Introduction

Every few years something like magnetic recording or wide-screen photography comes along and there are several years of accelerated activity in the motion-picture field; 1956 was not such a year. Wide screen, stereophonic sound, and magnetic recording had all become routine. Several committee members reported that they were unable to find anything new worth reporting in their field, and some said that in the theater field research and capital improvement funds had been cut back: two newsreel companies stopped operation[1]; it was expected that 6000 movie houses would close[2]; for the first time all companies used joint film depots[3]; deals were initiated for studio mergers[4]; but Hollywood was busier than ever, and much of this was the result of television and other activity.[5]

On the other hand, in the field of television, there was continued progress. Another field, generally overlooked, is that of nontheatrical motion pictures. This has been growing at a steady pace for years, but now seems to be making rapid progress. These nontheatrical motion pictures include films on time-and-motion study, special-event films, high-speed photography in many scientific fields, time-lapse photography, propaganda films, educational films for school and industry use, documentary films, travelogues, sales-promotion movies, company newsreels, progress reports, employee training, TV news releases, personnel-recruiting films, government-control report films and general-audience films. While it is evident that most of these latter are low-budget films compared to entertainment films, they nevertheless call for increased film supply, new sound and photographic equipment, especially 16mm, and increased personnel to operate this equipment. Many of these pictures are made by nonprofessionally trained people and this calls for more information to be supplied by the SMPTE workshops, and other organized groups who have practical information to make available.

In writing a report of this type, there is a tendency to editorialize; and it seems that many Committee Members have the tendency to editorialize in their reports to the Chairman. In many cases reports have been left this way. Also, a number of quite lengthy reports have been received; where these reports contain material which has not been published (such as reports from other countries) it has been left intact because this is the only chance for many members to obtain this information.

Submitted April 8, 1957, by Lloyd Thompson, Committee Chairman, The Calvin Company, 1105 Truman Rd., Kansas City 6, Mo. The Committee makes an annual report, this report covering the calendar year 1956.

Suggestions for the Report on 1957

The present Committee and Chairman have agreed to write the report for 1957. We need several things:

(1) Better industry coverage. If you have been left out it is because we don't know about you. If you have something which should be included, send it to the Chairman or any Committee Member.

(2) More pictures. If possible cover every item with a picture.

(3) More reports from other countries. The *Journal* supplies world-wide coverage and is an excellent way of providing our world-wide membership with what is going on in other parts of the world. All developments are not concentrated in one country. If your country has been omitted, write the Chairman:

Lloyd Thompson, c/o The Calvin Company, 1105 Truman Road, Kansas City 6, Mo., U.S.A.

CinemaScope

The year 1956 was one of continued expansion and stabilization as far as the CinemaScope process was concerned.

During the year, there were 52 feature pictures released in CinemaScope, plus 21 pictures filmed in CinemaScope which were completed in 1956 for release in 1957. In addition, 7 pictures have been completed in another compatible anamorphic process. There were also a considerable number of short subjects and cartoons made in CinemaScope; the best available information indicates that a number in excess of 20 were made in the United States. These production figures do not take into account foreign production for which no summary records are immediately available.

In 1956, the SMPTE recommended a new film standard for CinemaScope. It was approved by American Standards Association as PH22.102-1956 on October 10, 1956. At the end of 1956 there were 40,929 CinemaScope installations throughout the world, broken down as follows:

Area	*CinemaScope Installations*	*Total Theaters*
United States and Canada	17,591	23,430
England	3,462	5,091
Australia	911	1,661
New Zealand	166	408
South Africa	340	613
Japan and Far East	2,376	9,737
France	2,325	5,635
Italy	3,544	8,754
Germany	2,973	5,682
Other European countries	4,553	13,084
Central and South America (including Mexico)	2,688	8,491

In addition to the foregoing, there were 2039 additional installations on order or being installed throughout the world.

The following table shows the distribution between magnetic sound and optical sound of the above CinemaScope installations:

Area	*Magnetic Installations*	*Optical Installations*
United States and Canada	4,609	12,982
England	465	2,997
Australia	145	766
New Zealand	20	146
South Africa	26	314
Japan and Far East	538	1,838
France	372	1,953
Italy	2,441	1,103
Germany	661	2,312
Other European countries	616	3,937
Central and South America (including Mexico)	432	2,256

It is interesting to observe that stereophonic sound has had extremely wide acceptance in Italy, and much less acceptance in the United States and Canada where one would normally expect such advances to be made most rapidly.

The other notable development is the use of CinemaScope in connection with 55mm wide negative film in the production of two important motion pictures, *Carousel* and *The King and I*. CinemaScope techniques were used in the photography; an entirely new series of camera lenses was designed and manufactured by the Bausch & Lomb Optical Co. for this purpose. New cameras, printing and processing equipment, etc., were designed; and the resultant reduction prints provided a CinemaScope picture substantially free from grain and containing useful pictorial detail information in excess of anything previously obtained. *Carousel* on February 16 and *The King and I* on June 28 were premiered in New York's Roxy Theatre with new composite CinemaScope projection lenses designed by Bausch & Lomb.

Exhibitor pressure on the producers during the year reached such a state that the decision was generally reached to provide combination magnetic-photographic release prints. These prints had been discussed earlier, the Motion Picture Research Council having approved the so-called Magoptical Release Print on November 16, 1955, but no uniform decision to follow this practice had been reached. While it is questionable whether this constitutes progress from a technical point of view, failure of the exhibitors to promote the quality aspects of stereophonic magnetic sound appears to make such composite prints a commercial necessity, since the restricted number of playdates enjoyed by stereophonic prints, under present distribution procedure, is not sufficient to justify their cost. It is of interest to note that since this decision was generally announced, there now appears agitation from exhibitor associations to expand the use of stereophonic sound; and it is of further interest that in the foreign field the Magoptical print has been rejected as unsatisfactory. Nevertheless, it is likely that 1957 will see a substantial number of feature releases in which the prints are combination Magopticals.[6]

Cinerama

At the end of 1956, 18 theaters in the United States had been converted to show Cinerama productions. One of these, in Oklahoma City, closed during the early part of 1957 because of "dwindling" attendance. This was the first Cinerama installation to close.[7]

SuperScope

SuperScope announced a new SuperScope-235 anamorphic print to match the dimensional characteristics of CinemaScope 2.35-to-1 optical sound print. These prints were made available in color or black-and-white and facilities for printing were made available in London, Tokyo, Rio de Janeiro, and Hollywood.[8]

Technirama

Microtecnica of Turin, Italy, announced a new projector developed in conjunction with Technicolor for wide-screen projection. Two systems were offered: one for standard 35mm film and the second with what amounts to a double 35mm frame running at 180 ft/min instead of 90 ft/min. A Delrama mirror-type anamorphic lens is used with an expansion factor in the ratio of 1.5 instead of the factor of 2 used in CinemaScope. The first production to be made in Technirama is the film *Monte Carlo* which had its premiere in Turin on December 19th.[9]

VistaVision

The VistaVision camera process was used during 1956 for all feature-picture production at Paramount Studios, both in color and black-and-white. Additional features were made in VistaVision by the J. Arthur Rank Organization, and *The Pride and the Passion* was produced by Stanley Kramer; the Daiei Motion Picture Co. in Japan adopted VistaVision for future production and are now furnishing their studios with this equipment.

The Williamsburg Story was made in VistaVision for Colonial Williamsburg, Va. The double-frame print on this film, which has six magnetic soundtracks, will be exhibited in two specially designed theaters.

At Paramount, new double-frame optical printers with many improved features were designed and built. Four of the lightweight hand-held VistaVision cameras[10] are now giving valuable production service in Hollywood, while others are in use in England and Japan. The feature picture *The Battle of the River Plate* was shown at the Odeca Leicester Square Theater, using the new double-frame projectors designed by the J. Arthur Rank Organization.[11]

Projectors

In the field of 35mm projectors, several companies announced anywhere from one improvement to a complete new line. Other projector companies wrote that they had nothing new to offer. Westrex led with the largest number of new items.

The Westrex line included The Westrex R10 Stereophonic reproducer for use with any modern projector to reproduce magnetic tracks. The Westrex R6 photographic sound reproducer featured special timing belts. The 51B multichannel magnetic preamplifier cabinet holds four preamplifiers with other control equipment. Other products were the 52A multichannel control cabinet; the

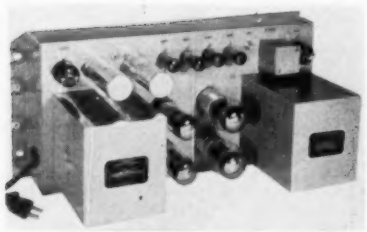

Fig. 1. The Westrex Sound System's Type 27 60-w power amplifier.

Fig. 2. The Westrex Sound System's Type 16 loudspeaker assembly with 80° high-frequency acoustic lens.

Westrex multichannel floor cabinet; the Westrex 27-type 60-w power amplifier (Fig. 1); the 48A single-channel control cabinet; the Westrex 49-type transmission for the single photographic system; a new loudspeaker assembly known as the Westrex type 16 (Fig. 2).

Westrex also announced a line of sound-reproduction equipment engineered to fill the needs of the medium-size theater and to take advantage of the new improvements. They include the Westrex Standard Multichannel cabinets to house up to 4 Type-26 30-w power amplifiers; a Westrex Standard 26-type 30-w power amplifier with new circuits to deliver more power with less distortion (Fig. 3); and a Westrex 47-type single-channel transmission cabinet.

Another line offered by Westrex is called Westrex Economy Sound Systems and this includes the Westrex R-11 photographic reproducer featuring silent-chain drives, oilite and ball bearings; and a Westrex Economy 45 single-channel transmission cabinet.[12]

RCA announced several new things for both indoor and outdoor theaters. For indoor theater use, a Six-Channel amplifier system was developed for use with the Todd-AO 6-track magnetic-sound and projection system. Five channels are used for stereophonic stage

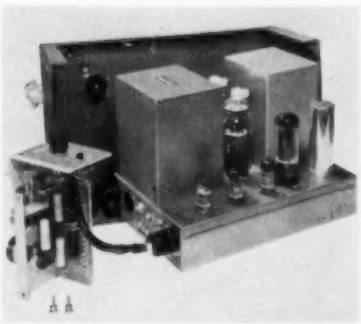

Fig. 3. Westrex Economy Sound System's Type 26 30-w power amplifier with its associated 24B preamplifier.

speaker systems and one track for auditorium-effects speakers. Essentially these amplifier systems include:

(a) A preselector switch for each projector station to preselect either the 6-track or the 4-track magnetic outputs from the Todd-AO projectors;

(b) A volume control and sound changeover for 6 channels, with muting and provision to operate also for 4-channel reproduction;

(c) Six channels of preamplifiers, with power-supply sources;

(d) Six channels of power amplifiers, available in either 15-w, 35-w, 70-w or 125-w/channel;

(e) Monitor amplifier and speaker, with provisions for monitoring any single track, or any combination of tracks, or all 6 tracks;

(f) Magnetic-optical switch, so that center-stage speakers can be connected to separate optical sound reproduction system.

Drive-In Theaters. RCA "Impac" In-Car Speakers. This unit consists of the same in-car speaker mechanism mounted in a completely new "miracle" material "Impac."

Curved Gate and Film Trap. This unit is being manufactured for any of the RCA-200 series projectors. It is readily adaptable to existing projectors in the field. Instead of pushing the film up against a pair of rather fragile metal guides, both the gate and film trap are of heavy construction so that this unit is able to withstand the daily wear and tear in the booth. The film pressure pads in the gate may be easily adjusted while the film is running (Fig. 4).

RCA Dyna-Heat In-Car Heaters. Marked improvement has been made in these units through the use of a single die cast member which incorporates a Calrod heating unit and the heat-dissipating fins all in one die-cast part. This unit simplifies field maintenance problems and gives a rigid, durable and low-maintenance item which has been much needed in this field.[13]

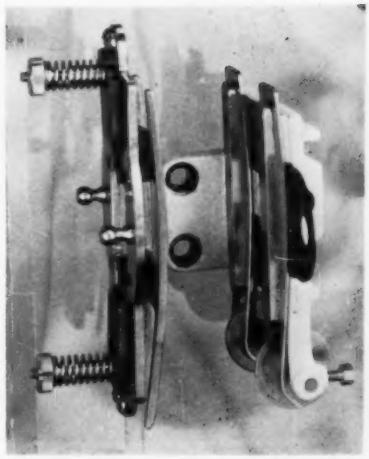

Fig. 4. RCA curved gate, for use with any of the RCA-200 series projectors.

General Precision Laboratories announced a curved film gate for new Simplex XL 35mm projectors and for modification of XL heads installed in theaters. This film gate, marketed by National Theatre Supply, developed by General Precision Laboratory for International Projector Corp., is designed to give the film sufficient rigidity in the aperture to resist the buckling effect of the higher light and heat levels of wide-screen projection. Buckle reduction of 30 to 40% with the curved gate keeps the film plane within the depth of field range of the lens for longer time intervals. Also, the average focus position of the lens lies closer to the zero plane which results in better center-to-side focus on the screen.

The new gate reduces film-frame motion after pulldown and provides less disturbance of strain pattern. Furthermore, badly buckled films which previously could not be held in focus because of negative and positive buckling can be shown with fully acceptable results with the curved gate. Thus, in addition to greatly improved picture definition, the new gate design contributes importantly to longer print life. The newly developed gate was first used on June 28 for the premiere of *The King and I*[14] (Fig. 5).

Fedi of Milan, Italy, announced their new Fedi XII T projector. Among other features this projector permits the immediate changing of projection ratios without halting performance. The light beam is cooled by filters. The machine can play either photographic or magnetic soundtracks.[15]

Optics

A lens of extreme high speed, the Super-Farron $f/0.87$, was introduced by the Farrand Optical Co. This lens has been designed in a focal length of 76mm to cover a 40mm-diameter field and is especially suitable for use with image-orthicon cameras and 35mm pho-

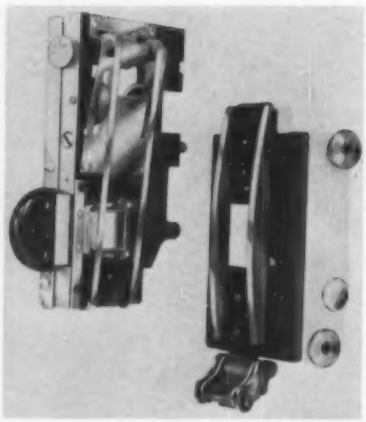

Fig. 5. Curved film gate for Simplex XL 35mm Projectors developed by General Precision Laboratory for International Projector Corp. and marketed by National Theatre Supply.

tography. In addition to the standard infinity correction for direct photography, this lens can be supplied corrected for 16:1 magnification for fluoroscopic applications or corrected for 4:1 magnification for oscilloscope photography. It can also be supplied with correction for the envelope thickness of the TV pickup tube (Fig. 6).[16]

An improved version of the 150mm *f*/1.8 Pantachar long-focus lens has been made available by Astro-Berlin. This recalculated formula is said to be corrected for all wavelengths from 4000 to 6600 A and to yield finer definition and contrast. Like all other Astro lenses, this lens is supplied with a special dual-purpose mount so that in combination with special adapters the lens can be used interchangeably on cine and still cameras.[17]

Nikon introduced a high-speed lens of reportedly unusual resolution. This lens, 50mm *f*/1.1, is of 9-element construction and is mounted in a focusing mount with click-stop iris diaphragm.[18] Another 50mm *f*/1.1 lens, the Japanese-made Zunow lens, was also introduced.[19] A 35mm *f*/1.8 wide-angle Nikkor lens was also announced. This lens is said to be the equal of, or superior to, other lenses of slower speeds and similar focal length. Nikon also announced a 50mm *f*/3.5 apochromat intended primarily for close-up photography of colored objects.[18]

An ultra-wide-angle Canon lens, 25mm *f*/3.5, was announced for 35mm double-frame cameras. This lens combines speed and unusual coverage of 83°. It is of a 5-element construction.[20] The 35mm *f*/2.8 Flektogon lens of 64° coverage was introduced.[21] A new 400mm, 16-in. *f*/5.5 Meyer Tile-Megor telephoto lens of four-element construction was announced. This lens measures 11 in. in length and weighs $3\frac{7}{8}$ lb mounted in a focusing mount.[22] A 500mm *f*/5.6 tele-lens was announced by Century Photo Equipment Co.[23] Other long-focus lenses announced include the 5-element Canon 400mm *f*/4.5 and the 2-element 800mm *f*/8 Canon lens,[24] as well as a 1000mm, 40-in. *f*/6.3 Astragon announced by Sterling-Howard.[25]

A new remote-control Zoomar lens with a zoom range of 6-to-1 and a focal length of 20mm to 120mm was offered by the Zoomar Corp. This new lens has an *f*/value of 3.9 throughout the entire focal length. It weighs about $1\frac{1}{2}$ lb as mounted in a standard C mount. The resolution is reportedly in excess of 600 TV lines. Accessories include remote power controls.[26] Keystone introduced an 8mm movie camera complete with a zoom lens and coupled viewfinder. This lens, available only on the Keystone K-33Z camera, has a zoom range from 9.5 mm to 28.5 mm.[27]

A new high-speed ultra-wide-angle lens, the 10mm *f*/1.9 Berthiot Cinor, was announced for 16mm C mount cameras.[28] The Elgeet Optical Co. introduced a high-speed wide-angle lens for 16mm cameras, the 12mm *f*/1.2 Golden Navitar. It is reported that this lens, which has one aspheric element, is the first that has used such surfaces for a production camera lens.[29] A 1-inch *f*/1.5 lens, the Quinon, was announced by Steinheil for 16mm C mount cameras.[30]

The Bell & Howell Co. announced a new 16mm magazine-type motion-picture camera complete with an automatic photocell-controlled iris diaphragm — the 200-EE. This camera has a permanently attached 20mm *f*/1.9 lens in focusing mount.[31] Also announced by Bell & Howell was a wide-angle converter for the 200-EE camera. This attachment, which may also be used with the 20mm Sunomatic or the 25mm Super Comat, converts the focal length of these lenses to 13mm and 17mm, respectively.[32]

Eastman Kodak Co. announced a Bifocal Converter which is used with the 2-in. *f*/1.6 Ektannon projection lens to convert the focal length to either $2\frac{1}{2}$-in. or $1\frac{5}{8}$-in.[33]

Republic Pictures introduced a new wide-screen process, Naturama, using anamorphic lenses of small compact construction. The Cinepanoramic lens attachment, of cylindrical lens construction is reported to yield greatly improved definition and resolution. An especially designed adaptor attachment controls the simultaneous focusing of both the anamorphic attachment lens and the spherical camera lens.[34]

The Superama 16, announced by the Radiant Manufacturing Corp., is a 16mm dual-purpose anamorphic attachment lens used for both taking and projection. The lens, designed for use with taking or projection lenses of 32mm focal length and longer gives a 2.6:1 aspect ratio.[35] The Kinoscope anamorphic attachment for wide-screen effects

Fig. 6. The Super-Farron *f*/0.87 lens.

with 8mm or 16mm was announced by Projection Optics Inc.[36]

The Pictorial Co. introduced a combination 35/16mm anamorphic-attachment lens that serves for both taking and projection. This lens of fixed-focus design is said to be compatible with CinemaScope and excellent for both color and black-and-white work.[37] The Wydar prismatic anamorphic attachment unit for 8mm motion pictures was announced.[38] A new filter was announced by Tiffen which is said to overcome the bluish cast of the Vista domes of railroad cars. The filter designated CC30R is available in the usual range of sizes.[39]

The Bolex Underwater Case for photographic equipment at depths down to 330 ft was announced. This case, designed to hold any Bolex H-16 camera, is calibrated for any Kern Paillard wide-angle lens; Switar 10mm *f*/1.6, 16mm *f*/1.8, or the Yvar 16mm *f*/2.8. The equipment is designed to be operated from the outside while under water.[40]

A new John Oxberry-designed process camera, a combination of 35/16mm, for animation and optical printer work was announced by the Animation Equipment Corp. The camera has a shuttle-type movement with fixed-pin registration. A rack-over mechanism is provided for animation work. On the rack-over camera for 35mm film a 47mm lens is used while a 25mm lens is employed for the 16mm film.[41]

A Hi-Speed Additive Color Compensating Head developed by Fish-Schurman has been announced. This unit is designed with a single 1000-w light source and three electromechanically operated light valves and will provide color changes in 5 msec. Each light valve is controlled by five small solenoids to provide 32 printer steps.[42]

A telescopic tracker, built by the Fairchild Camera and Instrument Corp., has been described. This unit which uses both 70mm and 35mm cameras can trace a missile 300 miles away. The main

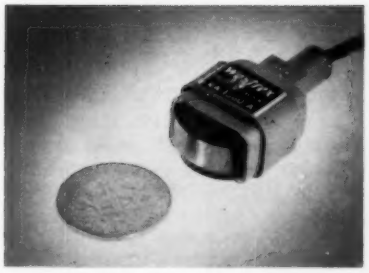

Fig. 7. Westrex magnetic head, Type RA-1580-A.

optical system of this tracker is a 40-in. focal-length, Cassegrain type of reflective optical unit. A turret of projection lenses of $\frac{1}{2}\times$ to $4\times$ magnification provides for an effective focal-length range from 20 in. to 160 in.[43]

Both Sylvania and General Electric announced new low silhouette projection lamps. The Sylvania lamp, the Tru-Focus, measures 4 in. high including the socket, burns in any attitude from horizontal to base down. The socket has been designed to make it possible for the lamp to snap automatically into prefocused alignment with the projection optical system. A new grid screen has been inserted to prevent lamp blackening when used in the horizontal position.[44] The G.E. Gold Top projection lamp measures $4\frac{1}{2}$ inches overall, is prefocused and has a 25-hr design life. This lamp, to be made in the popular 300-w and 500-w sizes, has no bare wires in the usual sense; three lead wires are covered with metal sleeves which snap-lock into the socket. The new design filament permits horizontal operation.[45]

The Farnsworth Model 105 Infrared Viewer using a 4-in. $f/2.0$ Wollensak Raptar lens was announced. This viewer utilizes a Farnsworth 1C16-3 tube and has a spectral response from 0.4μ to 1.2μ with a resolution of 400 lines/in.[46]

The Coleman Engineering Co. introduced several new instruments for the acceleration of photo-interpretation. Among these are the Coleman Boreader, an optical and electromechanical instrument for the rapid reading and recording of image position data from 35mm boresight cameras. Also included in the equipment described are a Powered Comparator and a High Speed Comparator for reading and recording data from $5\frac{1}{2}$-in. glass plates or film.[47]

Photographic and Magnetic Recording

New Westrex light valves (coded RA-1555 and RA-1562) for making push-pull direct-positive variable-area soundtracks and standard-release tracks were described by J. H. Jacobs before the Society's Hollywood Section.[48]

A method of making magnetic tracks visible by softening their surface with a suitable solvent was described.[49] Deformation of the softened layer results from the magnetic forces existing between the particles of magnetic material therein. Two papers were published on the subject of magnetic heads with replaceable pole tips or gaps.[50,51] These are particularly attractive for theater use with CinemaScope films. A comprehensive report on subjective flutter tests appeared in the *Journal*.[52]

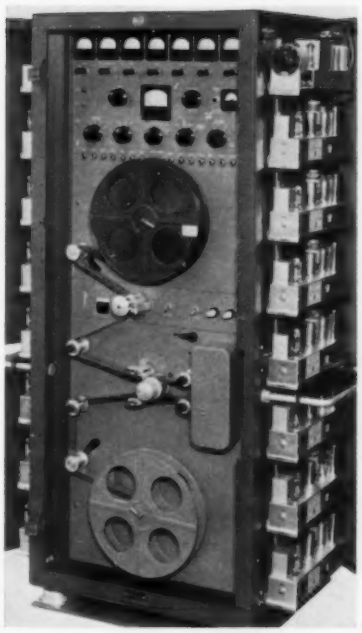

Fig. 8. RCA 7-channel portable magnetic recorder.

The 16mm version of the Westrex Editer has reached the field. This has the same film editing facilities as the 35mm Editer. Type RA-1580-A Westrex magnetic heads were employed in studio recording. These small heads feature extremely low hum pickup and may be installed anywhere along a film path since they do not require auxiliary shielding to obtain high signal-to-noise ratios. This performance is accomplished by means of an adjustable outer shield which may be adjusted to balance out hum pickup at the front and rear gaps throughout the life of the head. The construction also reduces low-frequency "bumps" in the reproducing characteristic (Fig. 7). Combination optical-magnetic reproducers coded Westrex RA-1570 type were installed in one of the major studios. Alternate threading paths provide maximum performance with either medium.

William A. Mueller of Warner Brothers makes the following observations: The Warner Bros. Production, *Giant*, although photographed as a standard (not CinemaScope) picture, was released for special showings with 4-track stereophonic sound. This required that the picture be printed on stock having CinemaScope perforations.

In re-recording operations, increased use is being made of $\frac{1}{4}$-in. magnetic tape for the reproduction of sound effects not requiring accurate synchronization.

There is an increasing demand for lighter-weight portable equipment. There is a demand for a very lightweight spring-driven $\frac{1}{4}$-in. tape recorder of professional quality to record nonsynchronous material and sound effects.

Recent additions to RCA's motion-picture sound-recording line are a 7-channel, portable, magnetic recorder (Fig. 8) and a transistorized mixer. The mixer is the first completely transistorized, commercial, multichannel mixer offered by RCA (Fig. 9). It is intended for use where portability and operating convenience, together with studio-type quality are the requirements. The mixer houses all of the necessary equipment required to amplify and control the output from the microphone amplifiers (approximately zero dbm) to a level sufficient to excite the magnetic-recording heads. All amplifiers used in this assembly are identical and are completely transistorized. Three amplifiers are used per channel: one booster amplifier, one recording amplifier and one monitor amplifier. In addition, there is provided in the mixer case a talk-back microphone booster amplifier, a spare amplifier to be used in emergencies, and a 400-c oscillator for set-up purposes.[53]

Studio-Designed Equipment

Low Flutter and Hum Magnetic Attachment to Projectors. To overcome the many objections of magnetic adapters to existing sound projectors, an external magnetic attachment was developed with a "Davis" tight-loop mechanism. The flutter is lower than the optical tracks reproduced on the same machines. Adequate shielding, not possible with internal adapters, is easily accomplished (Fig. 10).

Quick-Loading Recorder-Reproducer. A quick-loading recorder-reproducer film transport was developed; the prototype has since been in continuous use. The film is loaded as on a typical editing machine, and this device then automatically wraps the film into the drum-flywheels and filtered tight-loop of a "Davis" drive system as the take starts and "unwraps" again as the take ends.[54]

Automatic Re-recording Memory Device. A practical automatic memory device is in prototype use. This was successfully used in the complex scenes of *The Ten Commandments*. Using a 35mm magnetic-film transport as a recorder-reproducer, the device memorizes a mixer-attenuator control throughout a reel. The memory then repeats the control in subsequent rehearsals or takes. Alterations of the memory can be made and, if desired, the altered memory can be recorded and reproduced. The prototype controls one

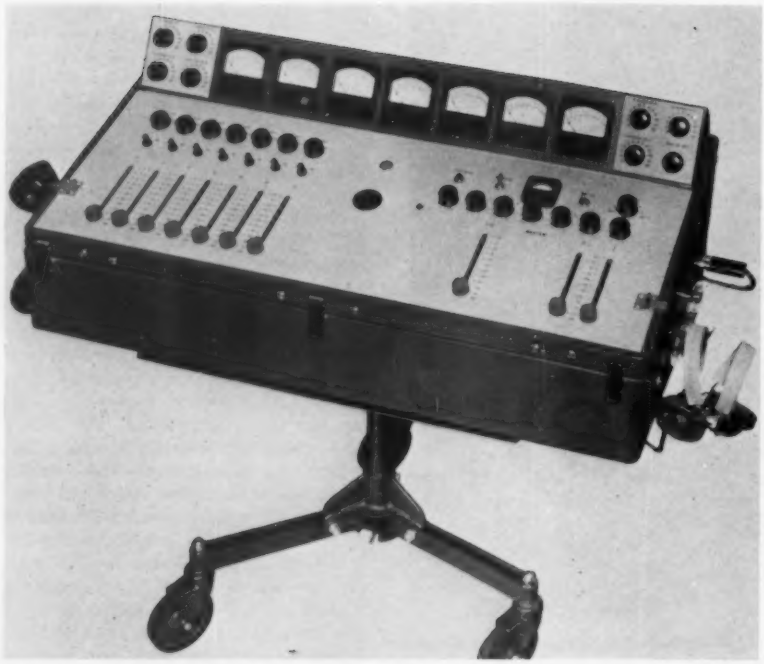

Fig. 9. RCA 7-channel portable transistorized mixer.

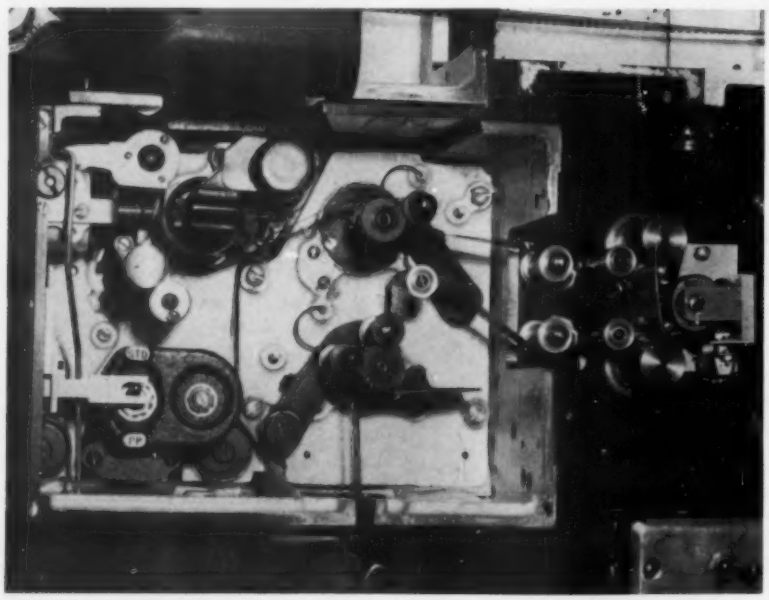

Fig. 10. Davis tight-loop magnetic attachment in use at Columbia Pictures Corp.

reproducer, although by adding equipment it can be made to control six reproducers and/or equalizers.[54]

Six-Track Equipment. Following the removal of the Todd-AO *Oklahoma* equipment from the M-G-M Studio, new 6-track recording and re-recording facilities were installed. These were flexible enough to connect with existing sound equipment and to be used with all existing types of sound recording. At the same time full projection facilities were provided for all picture forms — that is, 35mm, 65mm, CinemaScope, Wide Screen, etc. Arrangements were made for rapid and automatic changing of screen curvature and masking.[55]

Twentieth Century-Fox Studios. The prototype 6-track equipment successfully used on *Carousel* and *The King and I* is in process of completion and permanent installation. The studio theater has been completely equipped for 6-track presentation.[56]

Stereophonic Sound

The actual number of 4-track stereophonic CinemaScope release prints turned out during the year was much less than in 1955 due to various factors, principal of which was the added cost required for magnetic prints as compared to optical.

Notable advances were made in equipment at certain of the studios, especially at Twentieth Century-Fox and M-G-M with 6-channel stereophonic dubbing facilities which are thoroughly described by Templin.[57] In 1956, Twentieth Century-Fox released *The King and I* in 6-channel stereo and expects to release *The Greatest Story Ever Told* in 6-channel stereo in 1957.

Todd-AO continued the good work by releasing *Around The World in 80 Days* in 6-channel stereo.

The general tendency has been to reduce the number of stereo prints made for CinemaScope release although both M-G-M and Twentieth Century-Fox are overcoming one of the objections to stereophonic prints by including an optical track. At Warner Bros., Columbia and Universal, adequate facilities are available for dubbing and release-printing 4-track stereo and a limited number of prints are being made on CinemaScope releases at Warner Bros. at this time. Warner Bros. made a few 4-track magnetic prints with stereophonic music for the feature *Giant* even though the picture is a conventional, flat 1.50:1 ratio. These prints were very well received by the theaters and an unexpected demand has developed for them. Cinerama continues successfully to demonstrate stereophonic sound with its 7-channel separate magnetic print, as it has done for several years.[58]

Magnetic Recording

The year 1956 did not see the introduction of many basically new magnetic recording materials; however, it was distinguished as a year of perfecting existing products, further incorporating their use into the motion-picture industry, and bringing previously developed materials out of the laboratory and into field use. Several trends noted during the year were: (1) use of Minnesota Mining & Mfg. Co. #125 High-Output Magnetic Film on "stupendous" productions to obtain better signal-to-noise ratios on multitrack stereophonic recordings; (2) an increased use of 17.5mm portable channels operating at 45 and 90 ft/min. (There are considerable space advantages in portable recording on 17.5mm equipment with no loss in quality.); and (3) more widespread editing of magnetic film by motion-picture and TV producers. Editors are gradually becoming adept at working

with magnetic film and no longer need to rely on a visual (optical) soundtrack. Audio Devices, Inc., has found a demand for pretested magnetic film. Each reel is tested for sensitivity and frequency response. They have found it possible to maintain a manufacturing tolerance of $\pm\frac{3}{4}$ db.

The year also saw a renewal of interest in striped magnetic films. 3M Co. added to the number of laminator installations now serving the industry. Almost every area of the country now has a magnetic-laminating processor. Several of these processors have reported considerable interest in prestriped magnetic films (film striped before exposure and processing). CBS Television News reported that they are now using prestriped magnetic film for single-system recording on many of their news shows. They are expanding this operation as rapidly as station equipment can be made available. CBS reports excellent sound quality, previously impossible to obtain, by using photographic techniques.

Several special products related to magnetic-recording materials found use during 1956. Audio Devices uses a system of colored end tabs on recording tapes which identify both base material and thickness. The 3M Company is supplying a perforated 35mm abrasive coated film which is used by many manufacturers and studios to realign and rework magnetic-head clusters quickly. Also, the abrasive film is used as a lapping tool during the manufacture of heads. While intended primarily for instrumentation applications, the 3M Company developed an extremely wear-resistant magnetic coating that may find eventual use in the motion-picture industry. This magnetic coating substantially reduces friction between its surface and the recording heads and virtually eliminates rub-off. Under severe operating conditions its useful wearing life is many times that of normal magnetic-recording materials.[59]

Pyral announced world-wide Pyral service for striping prints.[60]

New Film Stocks

Black-and-White Films. The past year witnessed the introduction of several new and important black-and-white films by the Eastman Kodak Co. Outstanding among these was a new camera negative film, Eastman Plus-X Panchromatic Negative Film (Type B), Types 4231 (35mm) and 7231 (16mm). This new film carries the same name as its predecessor but is differentiated by the designation "Type B" and the code number "Type 4231" instead of the old number, "Type 5231." This new film is not merely an improvement on the old; it is an entirely new product incorporating the latest advances in emulsion and support manufacture.[61]

A new reversal camera film, Eastman Plus-X Reversal Film, Type 7276 (16mm) has also been introduced. This also carries the same name as a previous product, designated as Type 5276. Here again, the film is an entirely new material having better sharpness characteristics and lower granularity. The film has also been designed so that it can be processed in a manner similar to that employed for Tri-X Reversal Film, Type 7278. This new film finds wide application for general production work, including television production, wherever a reversal material is desired.

Eastman Reversal Duplicating Film, Type 7504 (16mm) has replaced the older product designated by the same name but as Type 5504. The new material has orthochromatic sensitizing, whereas the old material was only blue-sensitive. Granularity is much lower and the sharpness characteristics are greatly improved. The processing is carried out in the same manner as that used for Plus-X and Tri-X Reversal Films.

A new black-and-white material for making separation-positives from color negatives was also made available. This is known as Eastman Panchromatic Separation Film, Type 5235, and replaces the older material of the same name, designated as Type 5216. The new film has a slower development rate, thus permitting better control of contrast in commercial processing machines. It also contains dyes which are bleached out in the processing, eliminating any residual dye stain in the processed film, as was characteristic of the older film.

Eastman Embossed Kinescope Recording Film, Type 5209 (35mm), was introduced during 1956 for recording of color television programs from kinescope tubes.[62]

For high-speed photography, Kodak Linagraph Pan Film (Type 5244-modified, improved type, 16mm) has been introduced. This film is intended for negative use and represents a substantial improvement in the speed-graininess-definition relationship over earlier emulsion types. It has been designed to perform under average commercial laboratory processing conditions, whereas earlier types showed some sacrifice in speed under similar conditions. Even when development is forced to obtain the limit of its potential speed, the contrast is not excessively high. It has excellent exposure latitude and lends itself readily to projection use as a negative or as a negative from which prints are to be made for projection use.[63]

Du Pont increased the speed of its Kinescope recording film by approximately $1\frac{1}{2}$ stops over its 824 emulsion. The new emulsion is called 834B.[64] 1956 also stressed the wide usage of Du Pont Superior 4 Type 928B, which is a high-speed panchromatic negative film.[65]

Color Films

Beginning in 1956, there was wide-scale use of Eastman Reversal Color Print Film, Type 5269 (16mm). This film replaced the older material, Kodachrome Duplicating Film, Type 5265, for making color release prints from originals on Kodachrome Commercial, Kodachrome Daylight Type and Kodachrome Type A Films. The new film gives considerably better definition than the old. The contrast is also lower, an advantage for both first- and second-generation prints.

Sound quality has been improved by use of a silver soundtrack instead of the dye-sulfide type of track formerly used.[66] Where quantities of 16mm color release prints from color-reversal originals are wanted or where 35mm theater color release prints from such originals are needed, it is then feasible to prepare a color internegative which can be printed onto a color positive stock. Eastman Color Internegative Film, Types 5270 (35mm) and 7270 (16mm) were introduced for this use. This film contains incorporated color couplers which provide masking and this aids in obtaining good color reproduction when the internegative is printed onto Eastman Color Print Film, Types 5382 and 7382. Special effects can be incorporated in making the color internegative. Processing of the color internegative is carried out in the same solutions as those used for the color positive stock, eliminating the need for a separate negative process or an expensive and complex color-reversal process.[67]

Since the advent of negative-positive color systems, special effects were introduced either by A and B roll printing techniques or by making black-and-white separation positives and color internegatives. This procedure is both cumbersome and costly and efforts have been directed toward providing a multilayer color film which would eliminate the necessity of making separation positives except where they are needed for protection of the original color negative against damage due to fading or other causes. A color material of this type, Eastman Color Intermediate Film, Types 5253 (35mm) and 7253 (16mm), was demonstrated in 1956. This material can be used for preparation of both color master positives and color duplicate negatives and the latter can be printed onto Eastman Color Print Film: Types 5382 and 7382. The processing is carried out in the same solutions as used for Eastman Color Negative Film, Type 5248 with the exception of the bleach solution. The definition and color reproduction characteristics of this system are excellent and extensive use of the new film is predicted in the coming year.[68]

Multilayer color films on the world market at the beginning of 1956 included those manufactured by 11 companies,

Fig. 11. The Bell & Howell 200-EE Automatic Exposure Camera.

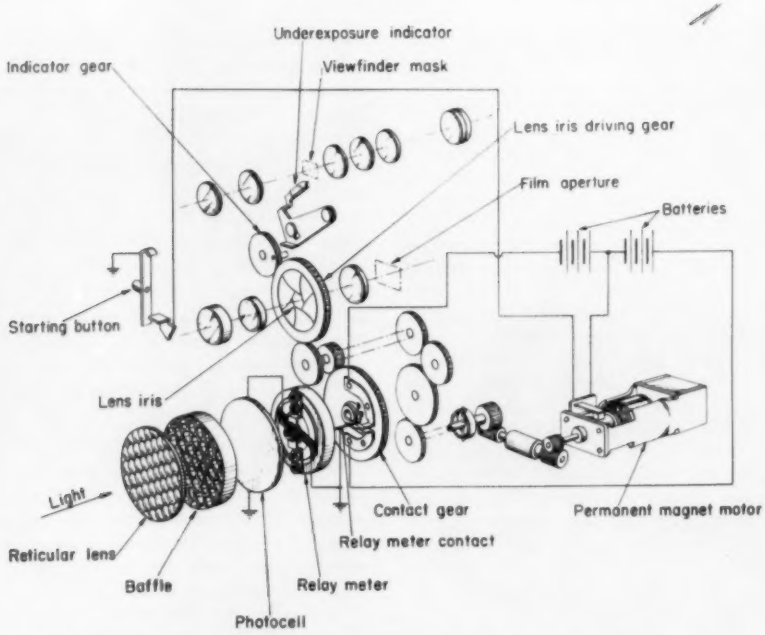

Fig. 12. Schematic of the Bell & Howell 200-EE Automatic exposure system.

films being Anscocolor, Kodachrome, Ilford Colour, Fujicolor, Kodak Ektachrome, Ektacolor, Gevacolor, Ferraniacolor, Agfacolor, Telcolor, and Pakolor.[69]

Laboratory Equipment and Techniques

A method was described for increasing the washing rate of motion-picture film wherein certain salts were incorporated either in the wash water or in a separate bath prior to washing. These principles are incorporated in the Kodak Hypo Clearing Agent, commercially available. The effectiveness of the bath is most striking with films fixed in strongly hardening alum-fixing baths and washed in cold water. The technique is applicable to machine, spray and rewind processing of motion-picture films. Savings are effected in time of washing and the amount of water consumed and low levels of residual hypo are attained.[70]

Processing methods for Eastman Plus-X and Tri-X Reversal Films were described. Recommendations were made for processing-bath composition and replenishing practice for obtaining highest quality and consistent results at both normal and elevated temperatures.[71]

A method was described for improving the contact in motion-picture printers through the use of internally directed air against the base of the negative.[72]

Various techniques for scene-change cuing in motion-picture printing were reviewed and methods were described for improving the conductive-patch scene-change cuing technique. A pulse-delay mechanism was described which makes notch covering or cue replacement unnecessary. Further work is in progress in connection with preparation of an American Standard on scene-change cuing technique.[73]

An experimental machine was described for cleaning of motion-picture film using a detergent solution. The successive stages in the machine included spray application of detergent solution, spray rinsing, squeegeeing and impingement drying, the total time required being about 12 sec. The machine is also useful for removal of alkali-soluble lacquer coatings.[74]

Continuous replenishment of processing solutions, in an effort to obtain constant chemical composition, necessitates the mixing of large volumes of replenisher and the continuous overflow of solution from each machine tank. Since developer chemicals, particularly those used in color processing, constitute a large portion of the processing costs, a method of recovering or re-using the developer overflow would result in reduced costs. A method of decreasing replenishment costs for Eastman Color Negative and Print Film developers by recovering overflow developer, using an ion-exchange method, was described.[75]

Accurate color timing of motion-picture negatives in color printing requires a knowledge of the relationship between printer light intensity and log E values. Information is also needed relating color-correction or intensity-changing filters to log E values. A method suitable for the calibration of both additive and subtractive type motion-picture printers has been described.[76]

Various techniques of using exposure meters have been evaluated in relation to the consistency with which high-quality results could be obtained in the exposure of two motion-picture negative films, for sixteen outdoor scenes. Results were evaluated on the basis of final screen image quality of the projected prints.[77]

A study has been made of the various factors governing the design of large reels for projection of 16mm film. Useful relationships between size, capacity, stiffness, weight, and effective weight have been described for all 16mm reel sizes. The conclusions reached from this study have resulted in proposals to change certain recommendations contained in the ASA Standards.[78]

The requirements for image analysis of Eastman Embossed Kinescope Recording Film, Type 5209, have been outlined and it has been shown that these requirements are similar to those used in projection. It was shown that a simple modification of a Westrex Densitometer could meet the requirements for densitometry of the embossed film.[79]

In Hollywood, Consolidated Film Labs opened a new laboratory in Burbank to process lenticular black-and-white film for Kinescope recording for NBC. This laboratory is equipped with all spray-processing machines with modified impingement drying.[80]

Cameras

Most of the camera developments for 1956 seem to be in the 16mm and 8mm fields. Paramount with a lightweight Vista-Vision camera and Oxberry's 35mm/16mm process camera are the only entries in the 35mm field.

The first commercial movie camera with a fully automatic exposure control was developed by the Bell & Howell Co. Called the 200-EE, the camera uses the same basic casting as the other Design 200 models with a new and slightly larger front plate substituted for the old, as well as a new casting added to the bottom (Fig. 11). Electric current is

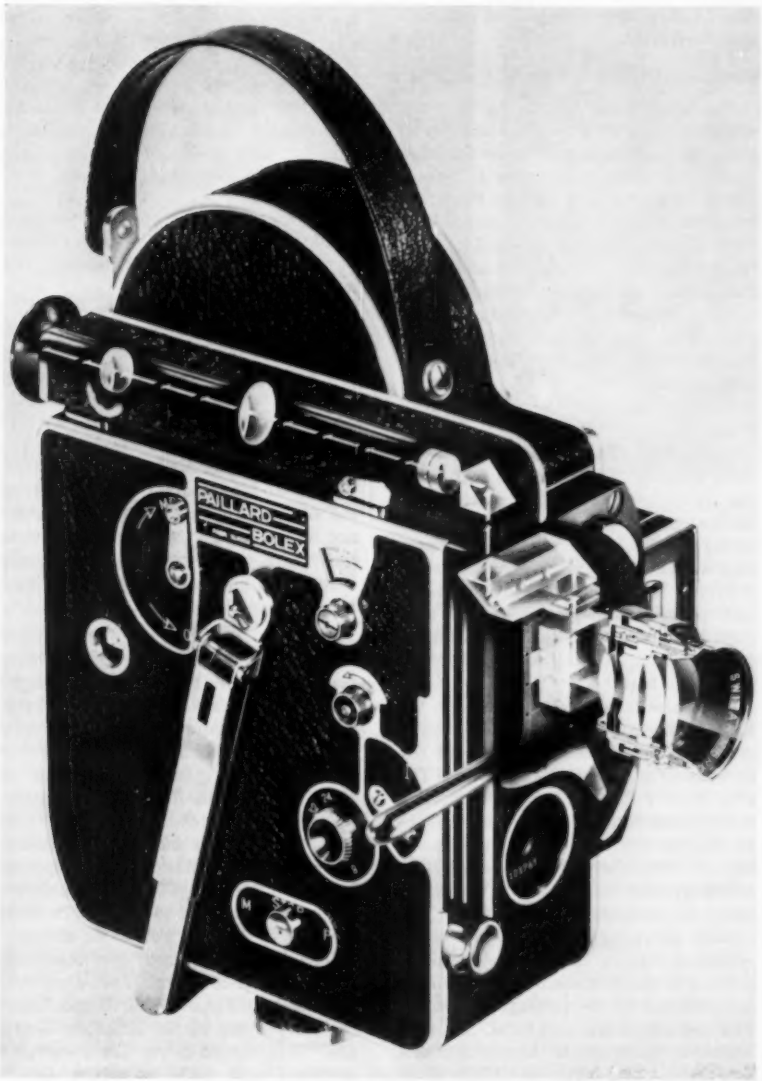

Fig. 13. Cutaway view of the Bolex H-16 Reflex focusing system.

developed by light striking a photocell. This current activates a relay meter and completes a circuit through mercury batteries, a miniature contact gear, and a miniature electric motor. The motor then drives the lens iris and adjusts to varying light conditions as shown in Fig. 12. A warning flag in the viewfinder indicates when light is not sufficient for adequate exposure. The control adjusts for camera speeds from 16 to 64 and for ASA film exposure from 10 to 50.[81]

A new self-contained, hand-held, 16mm single-system magnetic-sound camera was developed by Magnetic Sound Corp. This camera incorporates a transistor audio amplifier, transistor bias oscillator and power supply for both, built inside the camera body. The viewfinder has a built-in VU meter, parallax control, and optical adjustment which compensates for lenses with focal lengths from 10mm to 4 in. The unit can be operated with the microphone 2 in. from the camera without recording any mechanical camera noise.[82]

Paillard Products, Inc., announced the new Bolex H-16 Reflex. This camera features the new Bolex reflex focusing system, which makes possible viewing and focusing through the taking lens before and during shooting (Fig. 13). The image is picked up behind the lens in front of the shutter by a semireflecting double prism, and is viewed right side up and 6 times enlarged from behind the camera through the direct viewfinder. Since the reflex prism affects the optical correction of short focal length lenses, a line of specially designed Kern-Paillard lenses has been designed.[40,83]

Hanimex (U.S.A.) Inc., introduced the new AK 16mm Movie Camera which features a reflex finder, a variable shutter

Fig. 14. The turret model of the Ciné-Kodak K-100 Camera.

fully adjustable from 0° to 180°, quick-change magazines in various film lengths, a three-lens turret with all three iris diaphragms fully coupled to maintain constant exposures as the lenses are rotated on the turret, and a 12-v battery-operated, governor-controlled motor.[84]

The Keystone Camera Co. introduced two Zoom-lens 8mm movie cameras: the K-33Z 8mm rollfilm camera and the K-42Z 8mm magazine camera. The EdnaLite autofocus $f/2.4$ zoom-lens makes possible at least 12 practical focal lengths, from 9.5mm to 28.5mm, and is coupled to the viewfinder through a gear-train.[85]

A turret model of the Ciné-Kodak K-100 Camera made its appearance. This model mounts three Kodak Cine Ektar lenses together with matching viewfinder lenses, allowing instant change from standard to wide-angle to telephoto shots. Auxiliary lenses and viewfinders to fit the turret are also available. Other features of the popular Ciné-Kodak K-100 Camera have been retained (Fig. 14).

Gun and Missiles Cameras. A target analysis or "gun" camera, which automatically compensates for changes in light conditions, was offered by the Fairchild Camera and Instrument Corp. Actual illumination received through the picture-taking lens can be compared 64 times/sec with illumination from a reference lamp inside the camera. Proper film exposure is insured by the lens diaphragm changing to match the level of the reference lamp. The closed-loop system drives six lens stops in 1.8 sec.[86]

With the increasing need for production-type cameras to record flight characteristics of guided missiles, as well as data in the study of related fields, several manufacturers announced the availability of compact, rugged movie cameras built for installation in missiles. The Fastair 16mm Missile Camera was developed by the Wollensak Optical Co. The camera employs a rotating four-sided prism-optical compensating system, and three readily interchangeable

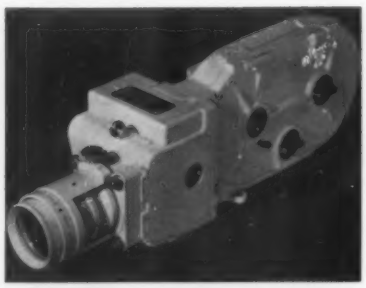

Fig. 15. The Wollensak Fastair 16mm Missile Camera.

motors, which will provide picture-taking speeds from 12 frames/sec to 600 frames/sec. Sturdy construction makes operation possible under 50-g loads normal to the spool sides and 100-g along the other principal axes (Fig. 15).[87]

Gordon Enterprises announced a 16mm missile camera known as the 55-GE. It photographs the flight path, missile instrumentation, and terrain, sky or horizon. Correlation timing devices provide an accurate time base for analyzing data. The camera uses an intermittent film movement and holds 50 ft of 16mm film.[88] This company also presented a complete line of precision motion-picture cameras for photo instrumentation use. The cameras offer a wide choice of aperture proportions, speeds of operation, exposure values, total running times and operational characteristics in 70mm and 35mm film width.[89]

Process Camera. The Oxberry combination 35mm/16mm process camera, designed to meet the requirements of animation and optical printer work, was announced by the Animation Equipment Corp. The unit can be quickly changed from 35mm to 16mm by changing the lens, shuttle, sprocket assembly and magazine. This eliminates the need for critical realignment as is required when two cameras are employed on an animation stand or optical printer. The unit has fixed pilot-pin registration and a sprocket drive that accommodates portable and stationary stop-motion motors.[90]

High-Speed Cameras. The Fairchild Camera and Instrument Corp. began production of two portable motion analysis cameras, an industrial model and an airborne model. A rotating prism is used and the overall speed range is from 10 to 8,500 pictures/sec. The motor is coupled directly to the take-up spool. The film functions as a drive belt for the remainder of the rotating components.[91]

Professional Camera. Berndt-Bach Inc.' produced an all new Auricon Pro-600 Camera for 16mm optical sound-on-film, either single-system or double-system recording.[92]

Projectors—16mm and 8mm

A new projector, providing for both magnetic and optical-sound reproduction was made available by the Eastman Kodak Co. This equipment, known as the Kodak Pageant Sound Projector, Magnetic-Optical Model, utilizes the basic mechanism of the standard Pageant Sound Projector but with the additional components and accessories required for magnetic-sound recording and reproduction. The projector can accommodate film perforated along either one edge or two edges and striped with a magnetic track. It can also project standard prints having a photographic track on which a half-width magnetic stripe has been applied. The reversing feature of the projector permits re-recording of sections of the track in order to correct errors in the initial recording. Microphone and phono input receptacles are provided for recording of voice, music and special effects. The projector is contained in a single-case unit, with microphone, 8-in. speaker, 10-w amplifier and 2-in. $f/1.6$ lens.[93]

Two new features were added to the Kodak Pageant Projector to provide greater convenience in setting up the equipment and for easier operation. The new Type 4 Pageant Projector provides spring-loaded sprockets to absorb sudden stresses on the film when projection is started. This protective feature has been added without the necessity of additional idlers to complicate the threading. For greater operating ease, a single-switch, reversing feature has also been incorporated to assure smooth starts when the operator sets up the projector, starts the film to check sound and focus, and then wishes to back up the film to the first title frame (Fig. 16).

The Kodak Analyst II Projector now incorporates a rheostat control instead of a two-speed switch to provide a frame frequency of 6 to 24 frames/sec. This feature, shown in Fig. 17, is valuable in projecting silent films dealing with motion analysis.

An experimental magnetic-reproducer head for the Eastman Television Projector, Model 250, was described and demonstrated at a regional meeting of the Society. Some actual trade trials of this equipment were made at that time and these have shown it to be fully suited to the needs for a high-quality magnetic-reproducer head and one which will withstand the rigor of continuous day-to-day operation. The unit is also applicable for use on the Eastman 16mm Projector Model 25 and is expected to be available commercially during 1957.[94]

A further modification of the Kodak Analyst II Projector has been made by the L-W Photo Products Co. to make it more useful as a tool in time-and-motion studies. Frame-by-frame projection at full illumination, forward or reverse, with remote control in addition to the regular 6 to 24-frames/sec projection is provided. Other modifications available include a frame counter and a wide-aperture plate to permit viewing of timing marks on the film.

Telefunken, Berlin, Germany, announced an 8mm sound projector known as the talking-pencil line. It is a magnetic record-playback projector.[95]

Agfa in Germany also announced an 8mm magnetic record-playback projector, with 8mm magnetic striped film. It runs at either 16 or 24 frames/sec.[96]

An 8mm sound projector also appeared in Japan which is covered in the report for the Far East.

The Kodak Abstract Bulletin carried the statistics that in France today there are more than 180 firms producing equipment and accessories for use with 8mm, 9.5mm and 16mm film.[97]

Kinescope Recording

Kinescope recording of color television programming for purposes of achieving a three-hour time-zone delay was commercially inaugurated by the National Broadcasting Co. on September 29, in Burbank, Calif.; the first program so recorded was the *Esther Williams Aquacade* which originated as a live-color television broadcast in one of NBC's Brooklyn studios and reached the color-recording equipment in Burbank simultaneously via the coast-to-coast microwave facilities of the Bell Telephone System.

The process of recording of color televison utilizes a 35mm black-and-white embossed film manufactured specifically for this purpose by the Eastman Kodak Co.[98,99] By means of electronic circuitry designed and built by RCA specifically for this application, the NTSC composite color signal is decoded into electrical signals representing the red, green and blue of the original subject. These in turn activate three 5-in. kinescopes whose P-16 phosphor emits ultraviolet light and exposes adjacent, horizontal bands in the black-and-white emulsion behind the embossings — or lenticules — of the film base. Since the electronic images on the faces of the three kinescopes have been arbitrarily chosen as negative, three positive separation images are formed in the emulsion of a single, embossed film frame.

To process this embossed film, as well as other NBC, blacl -and-white kinescope recording films, Consolidated Film Laboratories established a special processing plant located only a few blocks from the NBC Burbank property. This plant is equipped with two 35mm black-and-white processing machines employing the latest techniques of spray development and impingement drying.[100]

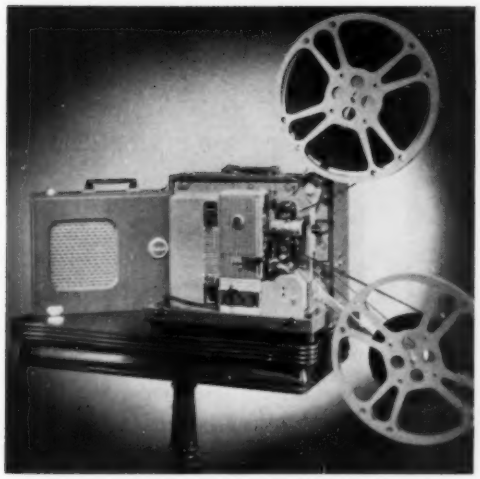

Fig. 16. Kodak Type T4 Pageant Sound Projector.

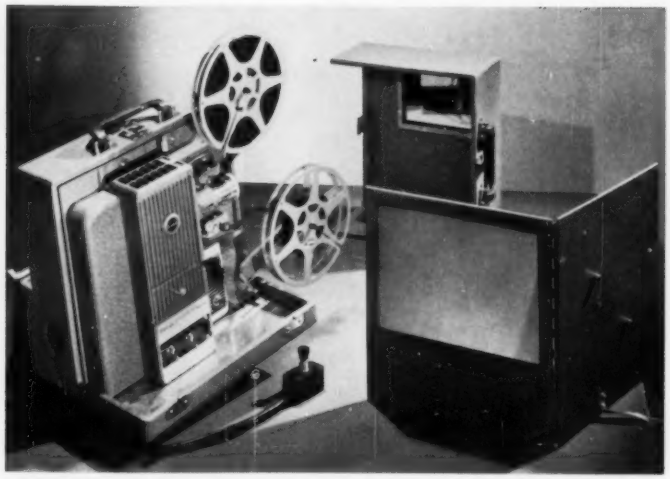

Fig. 17. The Kodak Analyst II Projector.

Since embossed film employs a black-and-white type of emulsion, a positive developer of conventional chemical ingredients can be employed.

Reproduction of embossed — lenticular — film is achieved by use of RCA TK-26-A 3-vidicon film cameras, with a slight modification. The modification consists of a small metal "thimble" placed just ahead of each of the three vidicon tubes, with a carefully positioned slit in each thimble, such that light from only the desired portion of each lenticule will fall upon the proper vidicon-camera tube. Thus, a density band representing "red" behind each film lenticule modulates the light of the projector; the slit in the thimble of the "red" vidicon is positioned to accept only light representing "red," etc. Since there is no "color" as such in either the recording or reproducing systems, "color" is produced only on the viewing tube of the broadcasting station monitors and of the home receivers. This system has been in operation since September 29, recording and reproducing roughly 1 hr of color programming daily on a 3-hr time-zone delay basis.

In the Spring of 1956 the American Broadcasting Co. inaugurated a unique system of kinescope recording to provide a 1-hr time-zone delay for monochrome TV programming beamed to the Central time zone, as well as a 3-hr time-zone delay for residents of the Pacific Coast. An installation was made in Chicago consisting of two General Precision Laboratory kinephoto monitors, directly connected to which were two 35mm Houston developing machines employing spray development and impingement drying. The processed direct positive film was then reproduced on black-and-white vidicon-film cameras, with only a 1-hr delay for viewers in the Central Standard time-zone area. The same film was reproduced again 2 hr later for transmission to the Pacific Coast viewing audience. This operation continued successfully throughout the Daylight Saving period, for which it had been specifically designed.

Electronic Photography

Although several methods have been devised for using electronic TV cameras as viewfinders for conventional motion-picture film cameras,[101–103] none of these systems had found wide acceptance during 1956. Several demonstrations of the Du Mont Electronicam equipment were made in Hollywood, but with no extensive usage.

Studio-Lighting Equipment

A new YF-101 gelatine filter was made available by the Mole-Richardson Co. for the 16mm × 22-in. Super High Intensity yellow-flame positive carbon[104] used in their 225-amp Type 450 Brute Molarc.[105] This filter may be used in place of the lacquer-coated Y-1 gelatine and therefore eliminates the necessity for a spraying operation.

New Baby and Junior "Combo" Fresnel lens incandescent spotlamps (Fig. 18) were developed by Mole-Richardson Co. The new lamps are of lightweight sheet steel construction with attached rotating barndoors of either the 2-door or 4-door type which results in a combination of the features of two previous designs. A Midget incandescent spotlamp having a cast-aluminum housing, with carriage which may be withdrawn from rear for re-lamping and servicing, was imported from Mole-Richardson, England, and made available in the United States by Mole-Richardson, Hollywood. The lamp accommodates lamp globes of wattage ratings of 50, 75, 100, 150 or 200.

A Quadlite (Fig. 19) made available by the Mole-Richardson Co., accommodates four separately switched reflector globes and may be stacked one above another on stands or wall brackets, with or without tilting quadrants.

A new portable 90-kw engine-generator set was developed by the Mole-Richardson Co. Its 2-wire d-c General Electric generator driven by a converted 1956 Cadillac gasoline engine will supply 750 amp at 120 v for lighting on motion-picture or TV locations. The unit is sound-insulated, weighs 4200 lb, has dimensions 36 in. wide by 82 in. long by 69 in. high, and may be shipped by air transport.

A new design of a portable dimmer board (Fig. 20), introduced by the Mole-Richardson Co., has two 5-kw circuits, four 2-kw circuits, and four 1-kw circuits. The 10 dimmer control levers may be operated individually or mastered in any combination.

A dolly was made available by the Mole-Richardson Co. for use in supporting and moving large lamp and stand assemblies over rough terrain on motion-picture or TV locations. The 3-wheel dolly has large 16-in. diameter tires of either the zero-pressure or pneumatic type and it may be pulled from a truck by trailer hitch.

The General Electric Co. extended their noise-free filament construction to include all of the 2-kw lamps used on motion-picture and TV sets. Likewise, a similar noise-free construction was developed and applied to the PS 52 bulb line of lamps for use in lighting units such as the scoops and broads. This construction eliminates the occasional objection to a slight hum, which could sometimes be traced to the light source in equipments used on stages with a-c power supply.

PS 52 bulbs of 750-, 1000-, and 1500-w ratings with 1000-hr design were made available by the General Electric Co., with silica coating, which is a perfect diffusing material causing the entire bulb

Fig. 18. Junior Combo, 1000 w or 2000 w, Mole-Richardson Type 2001.

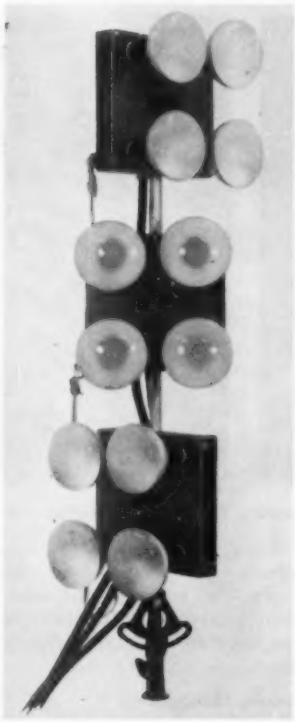

Fig. 19. Quadlite, Mole-Richardson Type 550. View shows three units stacked one above the other on quadrant.

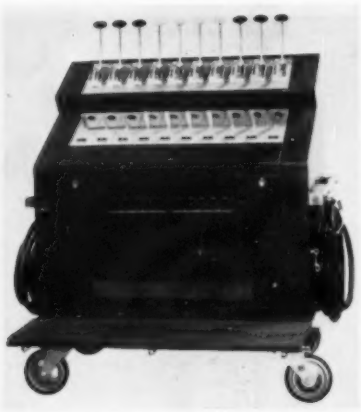

Fig. 20. Mole-Richardson Type 367, 10-unit portable dimmer board.

to light uniformly, thus eliminating the hot spot in the less diffusing inside-frosted lamps. An interesting property of this silica coating is that it provides the desired diffusion with no measurable loss of light. The lamps are suitable for use in reflectors where soft diffuse illumination is desired and in many instances they eliminate the necessity of additional diffusion on the fixtures.

Increased quantities of the 10-kw incandescent spotlamps have been used on large color TV stages where their relatively high light output is useful in attaining the levels needed.

General Electric Co. and Bausch & Lomb Optical Co. continued experimentation with interference film heat-control coatings on lenses and mirrors for spotlamps for the purpose of reducing temperatures on motion-picture and TV sets. The system was demonstrated at the Society's Convention at Lake Placid.[106]

Kliegl Bros. have developed a new spotlight known as the 3/2 oval lens spotlight. This may make it unnecessary to use barndoors in TV lighting.

Studio Construction Materials

Introduction and application of synthetic structural materials continued, giving ample proof of the fact that this industry is taking full advantage of modern chemistry's offerings. Emphasis on production economy curbed to some extent employment of costlier materials, and materially reduced availability of funds for new product development and general experimental projects.

Polyurethane-type resins were used in various prop shops for fabrication of semirigid and flexible objects (Fig. 21). It is predicted that anticipated early reduction in cost of these materials, and advancements in spray-gun application techniques will eventually place polyurethane foamed plastics far ahead of earlier lightweight structural materials for set-construction use.

Considerable work in refining methods for casting breakaway glassware from polystyrene resins has produced greatly improved techniques and end results (Fig. 22). Application of vacuum, pressure plates, efficient sealers for porous mold surfaces, and improved mold release agents have increased production rate and have almost eliminated fabrication failures.

Water base emulsion-type paints, particularly with polyvinyl acetate and

Fig. 21. Typical props made from polyurethane semirigid foam (20th Century-Fox Prop Shop).

Fig. 22. Breakaway glassware cast with Dow polystyrene PS-2 resin. Notice clarity of ¼-in. thick window pane separating wine glasses from bottle.

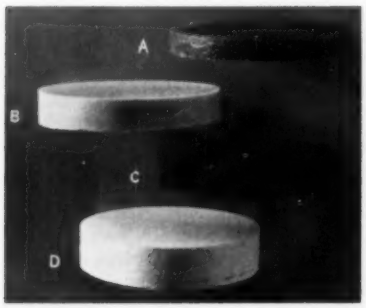

Fig. 23. A, polyester cast — 90% resin, 10% asbestos fiber (by weight); B, polyester cast — 90% resin, 10% glass spheres; C, polyester cast — 90% resin, 10% phenolic resin spheres; D, polyester cast — 90% resin, 10% ureaformaldehyde resin spheres. Notice differences in volume.

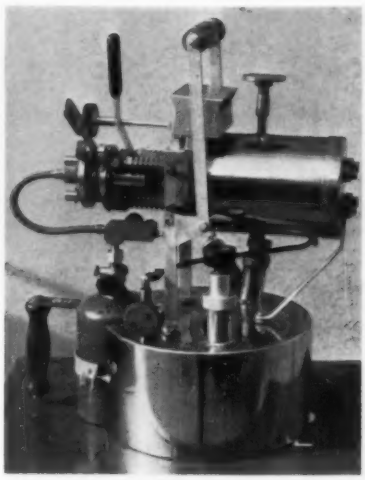

Fig. 24. Gas-fired fog machine developed by M-G-M Construction Dept.

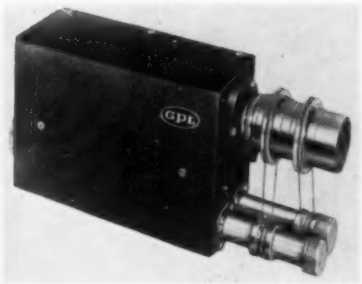

Fig. 25. General Precision Laboratory new Ruggedized Television Camera, Model PD-152.

polymethylmethacrylate binders, are preferred for both indoor and outdoor work. Cost reduction through incorporation of resinous fillers is favorably considered as well as improved formulations which yield coatings completely free of sheen and minimize undesirable graying which, as a rule, characterizes deep tone emulsion-type paint coatings.

Lightweight fillers for polyester resins, vinyl plastisols, and epoxy resins which give increased volume at equal weight are a major contribution in this important field of fabrication. These materials consist of minute hollow spheres of phenolic or ureaformaldehyde resin. An even more promising type presently being evaluated is inorganic in nature, consisting of hollow glass spheres (Fig. 23).

A new portable machine (Fig. 24) was developed, producing oil fog and capable of a large scale of volume modification from thin to extremely heavy fog. The particular merit of this equipment is that it is propane gas-fired making it independent of any outside source of energy.

Industrial TV

General Precision Laboratory completed the development of, and put into production, a Ruggedized Television Camera, Model PD-152, weighing 6 lb, to make possible the transmission of quality pictures under extreme environmental conditions. Incorporating significant advancements in design, the camera operates successfully while subjected to 100% humidity, temperatures ranging from −50 C to +60 C, ambient-noise levels of 175 db, 15 g's of shock and vibration in each of its three axes, and altitudes of greater than 60,000 ft. It is now in use for flight testing, rocket and jet-test stands, wind tunnels, automotive testing and military applications (Fig 25).

Development of a new portable television-projection system was announced by General Precision Laboratory. The PB-611A model incorporates a newly designed optical system to provide better picture detail and greatly increased light output, with picture sizes 16 × 20 ft and larger. This equipment has a new reflector and an advanced corrector plate design. The projection barrel uses optical elements 12 in. in diameter providing an aperture of 0.6. The optical system has been designed to simplify adjustment, and a new tube support is provided for easier and more accurate alignment and focusing of the projection tube.

RCA introduced its portable Telemural Monochrome and Color Projector, Type TLS 50/51, using three side-by-side Schmidt optical systems with three 2½-in projection kinescopes. Color pictures up to 4½ × 6 ft and 6 × 8 ft in monochrome can be shown.

Trad Electronics Corp. incorporated a unique electronic circuit called a Dynamic Contrast Expander in its latest model TPM 300. The circuit provides for approximately 30% more light output using conventional cathode-ray projection tubes. It increases dynamic contrast range and compensates for over- and underlighting at outdoor locations.

Industrial TV Expansion. A continued increase was noted in the use of closed-circuit big-screen projection television for sales meetings and information dis-

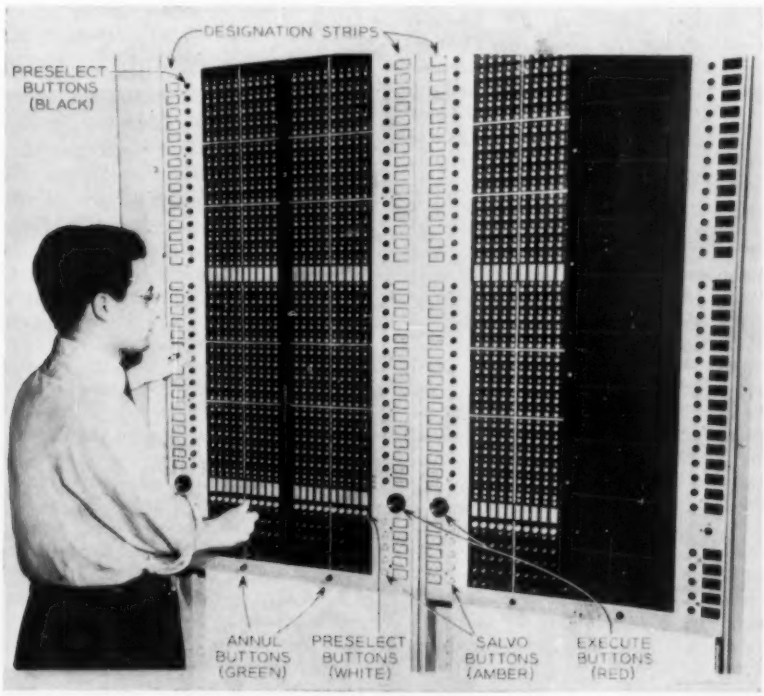

Fig. 26. Bell Telephone Laboratories switching-control panel — TV Operating Center.

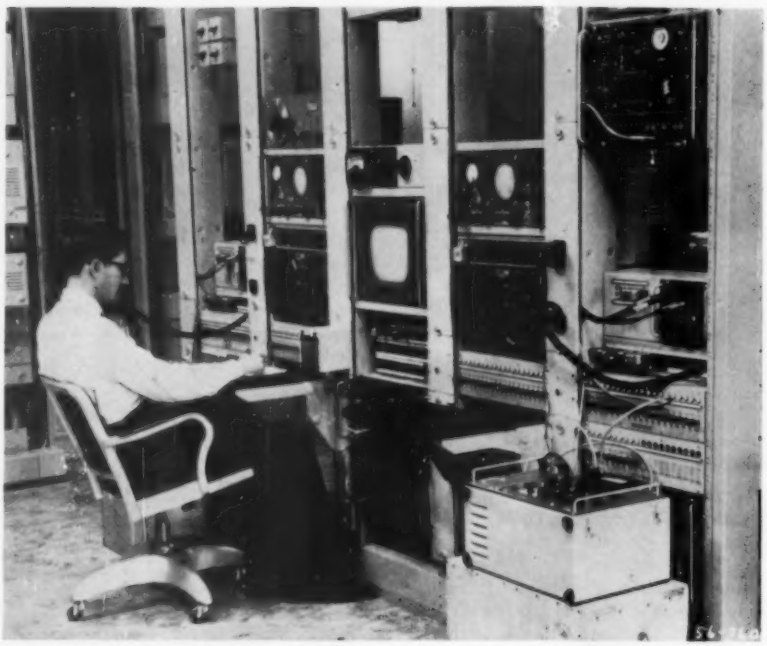

Fig. 27. Bell Telephone Laboratories monitor position for visual and audible check of TV programs.

play, and also in the number of companies staging these events.

General Precision Laboratory announced the installation of 133 of its new Model PB-611A systems for large-screen viewing of closed-circuit events. An increasingly important role was indicated for color projection via an announcement of the purchase of 40 RCA color units.

Projection TV systems were employed extensively in the political arena on such occasions as the "Salute to Eisenhower" dinners in over 50 cities across the country. Educational applications of the equipment also were on the rise on both school and college level. Outs anding among these are the installations at the Elmer L. Meyers High School, Wilkes-Barre, Pa., for large-screen auditorium viewing of broadcast educational TV programs by its entire student body of over 200 pupils, and at Fisk University, Nashville, Tenn. A similar technique is employed at the Nebraska Psychiatric Institute in Omaha for teaching psychiatric therapy via closed-circuit to large groups of advanced students from actual cases without disturbing the patient.[107]

TV Network Growth

About 5000 channel miles of Bell System TV facilities were added to the network in 1956, bringing the total to about 77,000 channel miles. Network service was available to 428 TV stations in 289 cities in the United States — a gain of 42 stations and 31 cities since last year. At the same time, the total channel miles of the network equipped for color transmission came to about 73,000. Color transmission was extended to 29 stations and 18 cities, thus linking 219 stations in 152 cities to the color network. A full report of the current status of the transmission of color over nationwide TV networks appears in this issue of the *Journal*.[108]

Switching Control at TV Operating Centers. A new type Long Lines TV operating center, specially designed to meet the stringent transmission requirements of color as well as black-and-white programs, went into service in Chicago, Los Angeles, and New York. The special feature of this TOC is a new video switch developed by the Bell Laboratories; it requires a special control panel (Fig. 26) to permit optimum use with minimum personnel fatigue and possibility of error. The control panel shows, with their corresponding lamps, "Preselect" buttons (black for incoming and white for outgoing lines), "Execute" buttons which effect the actual switch itself, and "Salvo" buttons which permit execution of several switches at once. To prevent the possibility of an accidental switch, the control panel is arranged so that no single button causes anything to happen; two buttons must be pressed simultaneously. Each TOC includes one or more monitor positions, for visual and audible check of programs being handled, and a maintenance position (Fig. 27) for testing any part of the switch and maintenance equipment.

TV Network Present and Future Growth in Canada. About 3800 channel miles of TV facilities were added to the Trans-Canada network, making a total of about 4600 channel miles. In 1957–58 a further 5000 channel miles will be added, completing the backbone network which will then extend from Victoria, B.C. to Sydney, Nova Scotia, a distance of about 3900 miles. Numerous spurs from the backbone route will serve TV stations across Canada. All new installations are being equipped for color transmission and the bulk of older equipment is in the process of conversion although color programming is not as yet in effect in Canada.

Microwave Order Wires. An unusual condition exists on this route between Long Lac and Fort William where, over a distance of six hops, a microwave system is used to provide an alarm system for another microwave system. Motorola microwave is used as an alarm facility for the Bell TD-2 system.

Stacked Telephone and TV. Extensive use is made on Canadian routes of "stacking." Up to 120 telephone channels are stacked on top of the TV channel over standard TD-2 facilities. They occupy a frequency band lying between 6 and 7 mc.

Community TV Progress. The Bell Company of Canada is actively engaged in providing facilities for r-f community TV distribution using 0.375-in. standard coaxial cable as used in video distribution. These facilities are supplied complete with amplifiers where possible, but rental of the cable only is available as an option.

Off-The-Air Pickup Service. Off-the-air TV service has been extended to six more customers of the Bell System, bringing the total to nine customers receiving this service. The Bell System offers this service whereby programs of a broadcasting station are picked up, off-the-air, at remote locations and relayed to another broadcasting station for rebroadcast. Since the video and audio signals are derived about 60 to 70 miles from a designated broadcaster, and are delivered by radio-relay facilities to the receiving customer's broadcast station location, economies are effected by the long initial jump, and by savings in buildings, towers, power-supply arrangements and related factors in the radio-relay system made possible by the so-called light-route construction. A long system of this type was completed during 1956 for Station KIVA near Yuma, Ariz. Los Angeles TV stations are received off-the-air at the 6500-ft Monument Peak about 130 miles away. From this mountain, about 40 miles east of San Diego, a single 98-mile microwave link connects to Station KIVA.

Closed-Circuit TV

An experimental project in education, which makes use of a closed-circuit TV network, is advanced by the Washington County Board of Education, Hagerstown, Md. It is hoped that educational television will relieve the present strain caused by the shortage of teachers, while taking advantage of the best talents of the teaching staff. The initial facilities, provided by the Chesapeake and Potomac Telephone Co., provide closed-circuit facilities for three simultaneous TV programs from five originating points to eight public schools. It is hoped that by 1958 the network may be extended to provide six TV channels and service to 48 schools in the county.

The network used employs a coaxial-transmission system, predominantly aerial with pole-type repeaters, operating broadcast TV frequencies in the 54–88 mc band. The equipment for this project, which is underwritten by the Ford Foundation, is supplied by many manufacturers associated with the RETMA.[109]

Color TV

Substantial advances in the color TV field took place. In order to cultivate the interest of viewers and to accelerate the introduction of color receivers, two networks stepped up the number of color shows, making at least one major color production available during evening program schedules. Station WNBQ, in Chicago, now broadcasts local originations completely in color. In addition, the number of color inserts, both local and network, has increased greatly.

The period has been one in which broadcasters have effectively acquired familiarity with color techniques and equipment, training personnel for the more complete shift to color programming which lies ahead. More than 230 stations now carry network-originated color programs. Live-color cameras are now in operation in 37 stations, and 85 are operating film-reproducing cameras for both color and monochrome film.[110] The transmitters and relay equipments in all of these stations have been modified and adjusted to operate within the narrower tolerances on amplitude and phase response required for good performance in color.

Receivers. The sale of receivers for color in addition to monochrome programs was spurred by the introduction of a new line of receivers with substantial improvements in performance at a cost below the "$500 barrier." Even though the sales for the year did not come up to original forecasts, over 100,000 new color sets went into service.

Programming. The color spectacular became an integral part of TV broadcasting, presenting lavish live-talent productions heretofore only available on the stage. Several full-length color film features were released for their first color TV showing. *Richard III* and *Wizard of Oz* demonstrated the technical excellence of the new medium and received enthusiastic audience response. Carefully prepared color prints of these features contributed in large measure to accurate control of the TV color picture quality. Direct experience in making films for color TV use has emphasized the need for careful control of lighting and staging to produce optimum contrast-ratio prints. Several weekly TV pioneer programs switched to complete color presentations as the vanguard of all-color programs anticipated in the next few years.

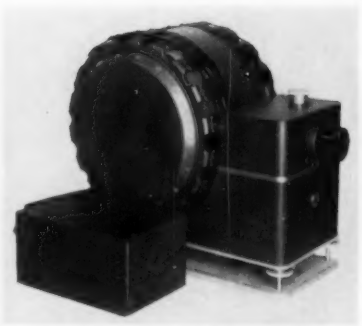

Fig. 28. RCA TP-7A 2 × 2 color transparency TV projector.

Network Performance Control. Progress was made in the development and network field evaluation of test signals capable of introduction within the TV vertical blanking interval. These will provide means for continuous measurement and control of signal quality in terms of amplitude and phase characteristics.

New Broadcast TV Equipment. In Fig. 28 a new 2 × 2 in. color transparency (TP-7A) projector especially designed by RCA for color TV service is shown. It uses two preloaded slide drums handling a total of 36 color, or monochrome, slides.[111]

The Translux Corp. introduced a slide

Fig. 29. RCA Color Television opaque pickup system.

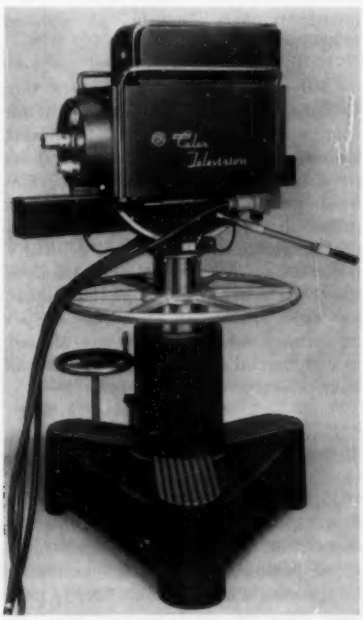

Fig. 30. RCA Color Television, TK-45, live color camera.

Fig. 31. Production VR-1000 Ampex Videotape Recorder Console. Machines of this type, which also employ two equipment racks each, are to begin factory production late this year.

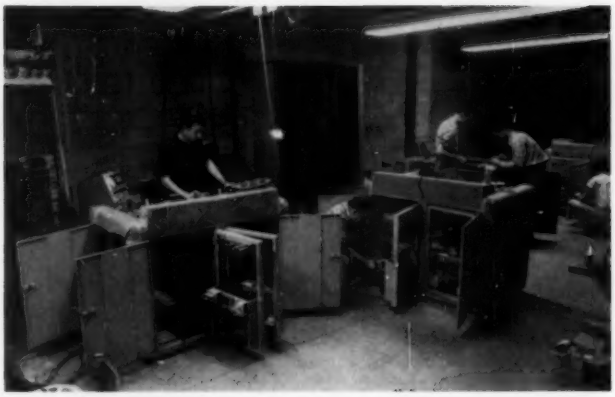

Fig. 32. Preproduction prototype Ampex Videotape Recorders in Ampex laboratory, under preparation for CBS. These machines are now in daily broadcast service, proving out design principles for incorporation in the production recorders to be delivered later.

background projector for television use known as the Translux "Little Wonder" Teleprocess Projector.[112]

Color projection monitors capable of producing as large as 6 × 8 ft pictures, and using 3-kinescope Schmidt optics were developed by RCA. These TLS-50 monitors will have wide application in TV closed-circuits and in broadcast service.[113] Opaque pickup optical systems which produce high-quality signals with standard 3-vidicon color-film equipment, an RCA development, are shown in Fig. 29. These permit the broadcaster to use a wide variety of presently available color opaque program material.[114,115]

New neutral density filter disks for light control were developed by Eastman Kodak and RCA. These use metallic-noncolor-selective films which show greatly improved stability at elevated temperatures.

Color TV Recording. Lenticular film recording and playback equipment for color was installed by NBC at Burbank for the time-zone 3-hour delay facilities required to rebroadcast color programs from East coast originations. Ampex magnetic videotape was experimentally demonstrated for commercial color TV transmission. Work continues in slow-speed "scanned" videotape equipment for color recording. Several Ampex equipment video recorders are already in commercial monochrome service and have produced excellent results.[116]

European TV. Experimental evaluation of compatible color systems continues in England and on the Continent. Philips demonstrated in Eindhoven a 9 × 12 ft color projection system using three 5-in. color kinescopes and high-speed Schmidt optics. Excellent resolution, registration and color fidelity have been obtained.

Closed-Circuit Color. Closed-circuit applications for color equipment received wide attention in the last 12 months. A great deal of interest has been shown by medical and dental schools in the possibilities for highly improved techniques in surgical and dental instruction. Several large-scale color TV installations were made for this purpose. The Walter Reed Army Medical Center color TV installation is the most ambitious program so far completed. A TK-45 live-color camera seen in Fig. 30 using three vidicons was specially designed for this application. While the present state of the vidicon-tube art limits the use of the cameras to fairly high lighting-level service where lag on motion is not particularly important, future advances will increase the applications in the broadcast field.[117]

A mobile compatible color TV system for closed-circuit service was used extensively by Smith, Kline and French Laboratories for medical, surgical and dental demonstrations to large audiences of physicians and surgeons from coast to coast. The use of color TV projection systems in these demonstrations has emphasized the effectiveness of color closed-circuit techniques in reaching large technical audiences.[118]

Color TV cameras are finding increased application in such fields as guided-missile observation and in allied closed-circuit investigations.

TV Studio Techniques

Videotape. In the field of production techniques and equipment for TV, 1956 will be remembered most as the year in which the first practical video tape recorder was placed on the market. Dropping like a bombshell into the April 1956 Convention of the NARTB, the Ampex machine became the subject of much talk and speculation about the future of the TV industry. It was sure to revolutionize everything. After a year of further development, Ampex has greatly improved its $75,000 prototype machines and is now filling the one hundred-odd orders at the production run price of $45,000 (Fig. 31).

Engineers at Ampex were working for five years behind closed doors while other firms announced partially satisfactory developments in the field but would not commit themselves on purchase price or date of delivery (Fig. 32). The principle which paid off is different from any previously announced. Instead of recording a magnetic track in the direction of movement of the tape, by moving the tape across a recording head, Ampex developed a spinning wheel containing four heads which laid down a series of very narrow tracks across a 2-in. wide tape. A delicate commutator feeds the video signal to each of the four heads in turn at the exact moment when each head contacts the tape, then switches the signal to the next head just as it begins to slide across the tape. In each linear inch of the standard Mylar tape, a total of 100 in. of magnetic track is laid down. The effective running speed of tape across-head is thus 1500 in./sec, although the tape actually moves through the machine at the standard sound-recording speed of 15 in./sec. The first technical descriptions of the Ampex system appear in the Society's April 1957 Journal.[119]

For the first time, then, an hour's videotape recording could be held on a reel of practical proportions. Drive, control and other mechanical aspects of the recording machine could be standard items from audiotape manufacture. Two of the prototype models were delivered to CBS and two to NBC in Hollywood in late 1956, for rigorous testing in daily operation. This began at the end of November, serving to record broadcasts which were seen live on the East coast, for playback three hours later at what was then the same time of day on the West coast. This so-called hot-kine practice has accounted for some eight

hours of kine-recording a day at each network; but within a few months videotape was being used for as much as half of this recording.

While the tape machines were in the experimental stage protection-kines on 16mm or 35mm, and in some cases both, were also being made and being run at the same time the videotape machines were in operation. Observers who happened to be watching at the rare times when switch-over to a kine was necessary, reported sudden very great loss in picture quality. Indeed, the resolution of videotape is only slightly less than that transmitted by the average TV station: 320 lines in the case of tape as compared with a broadcast 340. However, the average home receivers reproduce only 275 lines of definition, so videotape considerably exceeds their limitations. It is no surprise that the Ampex videotape is indistinguishable from a live broadcast to the average viewer.

The critical observer, however, will note one of the bugs in videotape in the shape of occasional white streaks across the screen, one scanning line in width. This is known as "dropout" and is caused by microscopic irregularities in the coating of iron oxide, never of any significance before when the tape was used only for sound recording. Until improvements in tape manufacture remove the dropout problem, these slight imperfections will alert sharp-eyed viewers to the use of videotape.

The multiple-use aspect of magnetic tape will make video recording vastly cheaper. Whereas a standard kinescope recording of a $\frac{1}{2}$-hr program on single-system film might cost $60, a half hour of magnetic tape is only slightly more — $85, and the tape can be used 100 times. On this basis, the tape cost for a $\frac{1}{2}$-hr recording would be 85¢. The video recording heads, spinning at 14,000 rpm across the tape, must be replaced after 100 hr of use at a cost of $300 per assembly, so this adds another $1.50 to the cost of a $\frac{1}{2}$-hr recording. In a situation where video recordings are not to be stored, but used only once or twice like hot-kines, this tremendous saving can be significant. The networks expect their videotape machines to pay for themselves in the first year of operation, as soon as the running of protection kines can be discontinued.

On the eve of delivery of the first production run units, engineers were hoping for the addition of a $1\frac{1}{2}$-hr reel so programs of this length could be recorded on one machine. A field unit was in view, which would make it possible to record events out of direct contact with the studio, or occurring at times inconvenient for broadcast.

An important need, from the standpoint of production use, was the elimination of the $7\frac{1}{2}$-in. displacement between the video recording and the sound which accompanied it. In the standard film camera or projector, sound and picture apertures cannot be placed together. The 26-frame displacement in motion pictures has long caused trouble for film editors, and some well-nigh unsolvable problems in the editing of composite prints. Since videotape is composite, and will probably not be used with separate soundtrack for most TV purposes, its use will be much broader if simple, direct, dead-sync editing is possible. Picture and accompanying sound should be opposite each other on the tape, and further development of the machine will undoubtedly add this feature. In the present machines, the heads have been placed beyond the videoheads, and the sound accompanying a given picture is placed opposite a picture which passed the videoheads $\frac{1}{2}$ sec before.

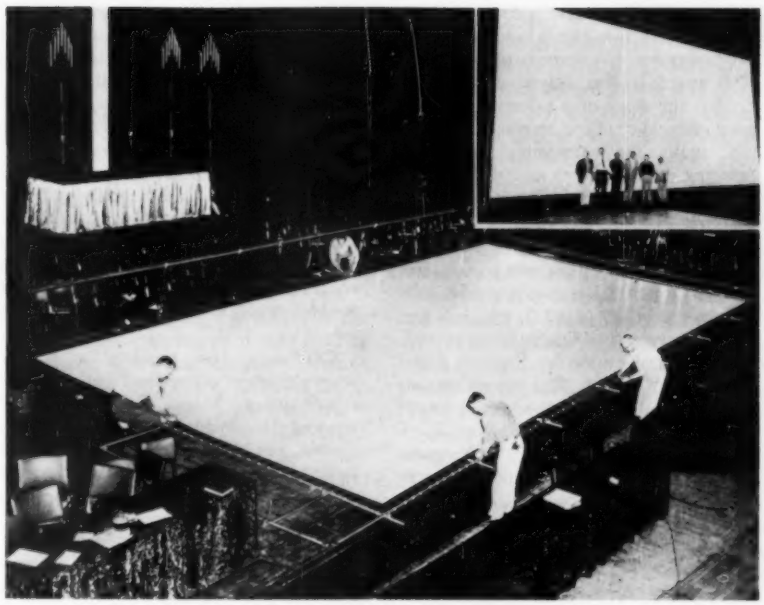

Fig. 33. Assembling a 20-ft × 40-ft portable projection screen; upper right inset, the assembled screen.

Dead-sync recording may be accomplished by placement of the soundhead at the same spot as the videohead assembly. On the other hand, it may be best to incorporate a delay mechanism which will hold the recording of the sound for $\frac{1}{2}$ sec until the proper spot has reached the soundhead, and then record it in dead sync. In playback, of course, a similar delay would have to be incorporated with a sound pickup head in advance of the videohead, so that the sound, although picked up $\frac{1}{2}$ sec before the picture, would be heard at the same time the picture is seen.

Another point in regard to editing is the question of equipment. Ampex has pointed out that no substantial reductions in cost seem likely for a play-back-only machine, so only one videotape machine will be manufactured with which recording, playback and editing will all be done.

Nontheatrical Films and Educational TV

Every year new uses are found for the motion-picture film. American Airlines has developed a plan for training pilots on landing procedures at each airfield along their routes, based on wide-screen filmstrips. A pilot using such filmstrips at his base to familiarize himself with the individual procedures can save days which were formerly required in going to each field to be "checked-out." This is required by the Civil Aeronautics Board. Officials at American Airlines are now working on a plan which would use motion pictures with a magnetic stripe for the sound.[120]

The use of "film-loops" in training situations has become an accepted practice in business firms. Seminar Films, for example, a producer specializing in making film loops for role playing, has developed them for such firms as Socony Mobiloil Co., Chase National Bank and the American Cancer Society. The Armed Forces have used the loops successfully for language training.[121]

Incorporating a split wide-screen and using two 16mm motion-picture projectors and a $3\frac{1}{4} \times 4$ lantern-slide projector, Commercial Picture Equipment and Wilding Pictures teamed up in a unique presentation for a Seagrams Distillers' sales meeting. The center screen was used with the slide projector to give economic statistics, past and future. The left screen was used to depict old merchandising methods, while the right screen showed future methods.[122]

Using a slightly different approach,

Wilding Pictures made a film for Swift & Co., using two 16mm motion-picture projectors and two screens placed about 10 ft apart. In this situation, one screen carried the story of a salesman doing a poor job, the other screen came "to life" with the salesman's conscience pointing out his errors and demonstrating the right approach.[123]

Religious Films. During a religious convention in Minneapolis, The Jam Handy Organization used a special projection screen, 20 × 40 ft, which is one of the largest portable screens on record. It was manufactured by Radiant Manufacturing Corp.[124] This screen equals in size the 30 × 30 ft screen used at Madison Square Garden in New York City the previous year for the National Education Association annual convention (Fig. 33).

In a study under way at the Eastman Kodak Co., it was revealed[125] that in the 40-yr period (1915–1955) 1573 religious nontheatrical films were produced:

	Films	*Percent*
1915–1945	193	12%
1946–1955	1380	88%

(Only films were considered which had at least 50% of the prints sold or rented to churches or synagogues and which were not shown initially in theaters or produced primarily for a television series.)

Educational Film. From 1946 through 1950, the Nebraska film project (known as the Nebraska Educational Enrichment Program Through the Use of Motion Pictures) attempted through a broad use of films to saturate six areas in the state by setting up regional area film libraries, and by making films available at no charge. In an evaluation six years after the project ended, the data below show the results in one area, based on the Teaching Materials Center at Wayne State Teachers College, Wayne, Neb.

In summary, Dr. Clifford V. Wait, director of the Teaching Materials Center, says "The four-year film experiment gave considerable impetus to the use of motion pictures in the classroom as well as to the development of audio-visual programs in general throughout Nebraska. Each year more schools are adding motion pictures to their audio-visual programs."[126]

Room darkening in schools has become a primary problem in audio-visual utilization. As classrooms bulge with the postwar baby crop, new schools are being built at an accelerated rate. With an estimated 161,000 16mm projectors in schools, the room darkening question is continually before architects who would avoid curtains wherever possible to save money.

California law requires a county superintendent's approval on all new school plans. Marin County Superintendent Dr. Wallace W. Hall has required that all new school plans include facilities for light control. It is expected that this ruling will be copied in other local school building requirements.[127]

Following the "do-it-yourself" trend, teachers are being encouraged to produce low-cost visual materials, such as lantern slides, by wet-mounting magazine pictures and other photographs for use in opaque projectors, by the use of high-contrast photography, etc. In the forefront of this program is Indiana University which has produced six 10-minute black-and-white films describing the various methods. These films are being purchased by school systems for in-service training programs.[128]

Educational Television. The use of educational television and closed-circuit TV in schools, colleges, and in connecting school buildings this past year received wide attention in experimentation across the country. Twenty-two education channels were on the air while countless closed-circuit installations went into operation. New York State Education Department allocated $200,000 for closed-circuit TV in two Long Island public high schools and two upstate teachers colleges.[129] In New London, Wis., a small TV camera was installed in a study hall with a receiver in the school's office to monitor the students (Fig. 34).[130] At Philadelphia's Temple University 50 dentists in the postgraduate school witnessed a 4-hr clinic via six 21-in. TV receivers.[131]

Results of Film Enrichment Program

	At close of project in 1950	*As of December 1955*
Total prints in library	200	500
Number on staff	Full-time director; one part-time student	Full-Time director; three part-time student assistants
Faculty use of films	500 bookings	900 bookings
Films secured off campus	250 prints	565 prints
16mm projectors on campus	2	4
Elementary and secondary schools using films (flat fee contractual arrangement)	12 (in 1951 when films no longer free)	16 (two schools added per year; one dropping per year)

Fig. 34. Five-pound camera, shown at top of picture, is trained on students in the New London, Wis., High-School study hall.

With the opening of the fall semester, probably the nation's most ambitious closed-circuit experiment began in Hagerstown, Md.[132] Six elementary and two high schools are linked by cable so that 4000 students are receiving instruction through the TV medium. Eventually programs will originate from both high schools, two studios in the Board of Education building, the city's museum and the public library. Receiving sets will be located in every school in Washington County when the installation is completed. Forty-one electronic, television, photographic and allied companies are building equipment for this project. Pittsburgh, Pa., added a physics course to its experimental public school curriculum and chose Dr. Harvey Elliott White, a full-time professor of physics at the University of California to teach the course. The course goes via television to 31 high schools in and around Pittsburgh.

At the time of telecast, *Encyclopaedia Britannica* is recording the entire series of lectures on 16mm Kodachrome. These then can be used in classroom projectors over the nation, including the 4000 high schools who have no physics courses.[133] A special camera using the same lens for both the TV image and the photographic image is used.

Dark draperies — a flame-resistant, vinyl-coated fabric to darken windows — has been developed for audio-visual work in schoolrooms and auditoriums by du Pont. Opaque drapery is color-patterned and textured on inner side, while neutral beige faces the window. Opacity comes from an intermediate coating of black vinyl.[134]

High-Speed Photography

The most important single event affecting this country's work in high-speed photography during 1956 was American participation in the *Third International Congress on High-Speed Photography* held in London September 10–14. Approximately 30 American workers in this field attended the Congress, delivering 14 of the 59 scheduled technical papers, plus two of three popular lectures, and serving as Chairmen of three of the 16 technical sessions. The Congress proved to be a highly successful one which provided American participants with an excellent insight into current developments in the field. The *Congress Proceedings* were promptly edited under the able leadership of R. B. Collins, and published early this year.[135] During the meeting, plans were made for holding the next Congress in Germany during 1958, and in the United States during 1960. The Proceedings of the *Second Congress*, held in Paris during 1954, were published during 1956.[136] The publications, *Third Congress* and other high-speed photography activities were reported in some detail in the *Journal*.[137]

Further refinements in powered-tracking mounts used in rocket and guided-missile photography were described by Dorsey,[138] amplifying previous papers on this subject.[139,140] The collimation of long-focal length lenses used on such mounts has also been improved by a process described by Frisbee.[141]

Humm and Quinn[142] provided a valuable listing of motion-picture films now available for high-speed applications. Use of high-speed photographic equipment for measuring accelerations of a steel sphere in free fall was outlined by Severy and Barbour.[143]

This year saw the appearance on the market of two interesting new lines of high-speed cameras. The Fairchild Motion Analysis cameras are available in two models, one designed for airborne use, the other for general use. The general, or Industrial Model HS-101, features interchangeable motors which provide ranges of operating speeds from 32 frames/sec to 5000 frames/sec.[144] The camera is light and compact, and can be hand-held during operation. The Wollensak Fastair camera[145] supplements the regular Fastax line by providing a compact camera especially designed for airborne or missile use. Normal operating speeds range up to 600 frames/sec. Examination of records made with these new cameras indicates that both the Fairchild and Wollensak cameras provide resolution closely approaching that obtained with intermittent-action cameras. Such cameras may well open up entirely new fields of high-speed photography in coverage of sporting events, industrial processes, and even advertising.

A new capping shutter for drum cameras employing a network of fine wires which is evaporated to provide a density of 3 in 30 μsec was described by Edgerton,[146] while another approach, using an explosive detonator which shatters a frangible glass block, was designed by Brixner.[147]

Bird, Miehe, and Edgerton provided an excellent study of flashtube efficiency, in which they measured the light output of 16 Pyrex flash-tubes of various dimensions as a function of voltage and capacity, utilizing an integrating light meter.[148]

A long-sought goal was achieved this year with announcement of the Fairchild Rapidyne aerial-camera shutter which operates at 1/5000 sec. Shutters up to 3½-in. diameter have been produced.[149] The Warrick Model F Oscilloscope Recording Cameras were announced. These 35mm cameras have capacities of 1000 ft of film and operate between 15 and 125 ft/sec.[150]

Great Britain

BBC TV Coverage. The coverage of the BBC TV service was extended from 93.5% to 96.4% of the population of the United Kingdom (total population 50.4 million). This was achieved by the following changes or additions to the BBC's TV transmitting stations which now number 15:

(1) The opening of the new London TV Station on the Crystal Palace site (e.r.p. 120 kw, Channel 1);

(2) The replacement of a temporary transmitter in the Isle of Wight by a permanent transmitter;

(3) The replacement of the temporary transmitter at North Hessary Tor, Devon, by a permanent one;

(4) The commissioning of the new permanent aerial for the transmitter near Norwich;

(5) The opening of a new temporary transmitter at Sandale, in Cumberland.

During the period, the number of TV licenses increased from 5½ to 6½ million.

New London Television Station. The London Television Station was transferred from Alexandra Palace to Crystal Palace on March 28. Much of the transmitting equipment at Alexandra Palace had been serving since it began the world's first high-definition public TV service in 1936.

The service from Crystal Palace was initiated using the output from the permanent transmitters (2 × 15 kw peak white, vision) working into an aerial (3-db gain) on a 250-ft temporary mast. On September 10 this aerial was replaced by another temporary array (6-db gain) erected at the 380-ft level on the partially completed permanent tower. Toward the end of 1957 the permanent aerial on the completed tower will provide a peak white vision e.r.p. of 200 kw.

The Crystal Palace station and equipment have been designed to provide a service of maximum reliability. There are twin vision and twin sound transmitters. The outputs of one vision and one sound transmitter are combined and fed to one half of the aerial system. Similarly, the outputs of the other two transmitters are combined and fed separately to the other half of the aerial. The breakdown of any unit in either of the transmitter-feeder-aerial chains thus only results in a 6-db reduction of e.r.p. without a break in the service. Comprehensive switching facilities are also provided between the transmitter outputs and the aerial system.

New Television Centre. Work is proceeding on the 3½-acre circular main block of the new Television Centre at the White City, London. Preparation for the foundations required the excavation of 70,000 cu yd of earth. When completed, seven studios will radiate from a central circular building containing control rooms, dressing rooms, and (in the higher floors) offices. A corridor for scenery transport will run around the periphery of the building, and give covered access to the adjoining Scenery Production Block.

New Studio Camera and Equipment. One of the Lime Grove studios has been re-equipped with the new Emitron camera equipment. The camera tubes are similar to the early cathode-potential stabilized orthicon in their method of signal generation, but differ in the scanning and beam-focusing arrangements and in having a more sensitive mosaic. There was a tendency for the potential of the mosaic on these earlier camera tubes to become unstable with excessive highlight brilliance. The effect has been almost completely overcome in the new tubes by the provision of an additional mesh (near the scanning side of the mosaic) which limits the potential excursion of the mosaic and prevents the instability from spreading beyond the actual area of excessive brilliance in the optical image.

Riverside Studios. Two new studios known as Riverside 1 and 2 were brought into operation, in June and in September. Both studios are equipped with image-orthicon cameras using 4½-in. tubes; there are four cameras in Studio 1 and three in Studio 2. Like all other BBC TV studios in use at present, these were not originally built for television but their layout approaches, more closely than ever before, the ideal arrangement for TV studios. The floor areas are 5500 sq ft in Studio 1 and 4500 sq ft in Studio 2.

Each studio has a large number of

year)

coating of black vinyl.[134]

lighting battens distributed over the whole ceiling and supported by separate motor-driven hoists. Each batten carries three or four individual light sources. The hoists in each studio can be raised or lowered from a single console on the studio floor. It is thus possible to provide the required lighting in any part of the studios by simply lowering the appropriate hoists without any of the previous man-handling of lighting equipment. The switching and dimming of all the illuminators (either individually or in groups) is controlled from consoles in each of the vision control rooms. The dimming is effected with thyratrons in one studio, and with resistances operated by magnetic clutches in the other, thus providing means of comparing the two methods.

In these studios, also for the first time, it has been possible to arrange the three control rooms for each studio (vision, sound and vision apparatus) immediately adjacent to one another on a common floor level. There are sliding windows between the three control rooms in each suite.

A new type of sound-control desk now installed in Studio 1 incorporates the features which have been found desirable for TV sound control. In television the process of cutting from one set to another requires more rapid changing of microphones than is usually necessary in sound broadcasting, where different speakers can often be grouped around a single microphone. The use of quadrant faders makes this rapid cutting easier than with the rotatable knobs on previous control panels. The provision of an attenuator in each microphone channel makes it possible to pre-set the gain in each channel during rehearsal. This means that the quadrant faders can always be pushed to the limit of their travel which also facilitates rapid cutting. Prefade listening facilities are also provided.

Regional Television Studio Facilities. Permanent image-orthicon camera channels have been installed in the studios at Birmingham, Bristol and Manchester. These replace the earlier "drive-in" arrangements where outside broadcast units were driven to the studios, and only their cameras removed from the vehicles, the control equipment remaining in the mobile control rooms.

Temporary studio facilities are in use at Cardiff and Glasgow.

Mobile Camera Vehicle. The original single-camera "Roving Eye" vehicle, which can transmit picture and sound signals to base while it is on the move, has been supplemented by another Roving Eye carrying two camera channels and a vision-mixing unit. Improved planning of the layout has made it possible to accommodate these extra facilities in a vehicle which is actually a foot shorter than the earlier version. Apart from the uses implied by its name, its value as a self-contained unit for outside broadcasts from fixed points will be greatly increased by the provision of two camera channels and vision mixing, and of a telescopic mast. The latter, carrying the transmitting aerial, can be extended, when the vehicle is stationary, to a height of 45 ft.

Television from a Submarine. Pictures were broadcast from a submarine at sea in June. These were transmitted to a nearby frigate using an aerial which remained above water when the submarine was at periscope depth, so that it was possible for viewers to see scenes within the submarine including views through the periscope. Because of the limited space in the submarine, two of the cameras on board were of the small photoconductive type. Vision and sound signals from the submarine were relayed to the shore from the frigate in which two further outside broadcast cameras were installed, together with the main control equipment.

Pictures From a Helicopter. In August pictures were transmitted from an airborne helicopter. Pictures had already been transmitted from a fixed-wing aircraft in flight, but there were several additional problems in adapting this technique to a helicopter. These were the weight of the equipment, the high noise level in the cabin, the low-frequency vibration of the whole aircraft, and the flutter on the transmitted signal caused by reflections from the rotor blades. The weight problem was eased by the fact that the power supply for the whole equipment could be obtained from the 5-kw 28-v d-c generator incorporated in the helicopter. The noise level was kept down in the transmitted sound signal by the use of a lip microphone with a wind shield. Every piece of the equipment was tested for microphony, but the only parts requiring modification were some of the amplifier tubes in the camera (but not the image-orthicon tube itself). The visible effect of vibration was minimized by using a spring-mounted camera platform. The flutter in the signal transmitted from the aircraft caused by reflection from the rotating blades was dealt with by modifications to the AGC circuit of the vision receiver on the ground and the line-stabilizing amplifier which followed it.

Television Broadcast from Dover Lifeboat. In November the Dover lifeboat carried television cameras and radio-link transmitters which were in operation throughout its 6-mile journey to the South Goodwin Lightship. This lightship is moored on the notorious Goodwin sands off the south-east coast of England. One image-orthicon and one vidicon camera were installed on the lifeboat and followed the progress of the lifeboat from Dover harbor to the lightship. When the lifeboat made fast alongside the lightship, the vidicon camera was moved on board the lightship with a cable running to the equipment on the lifeboat, and pictures were then transmitted from the lightship.

The vision signals were relayed from the lifeboat to the shore on a 645-mc link and picked up at the repeater station at Swingate, near Dover. From Swingate the signals were passed to the shore-based mobile control room on a 4000-mc link and from there over the permanent Eurovision circuit to the studios in London and the BBC's television audience.

Acquisition of Ealing Film Studios. The film studios at Ealing were acquired by the BBC in January for the purpose of making TV films. The lighting arrangements in the "stages" have been modified to give more economical operation with the simpler type of shot which is characteristic of TV-film making, as compared with feature-film production. The film dubbing and cutting facilities have been considerably extended. By the end of the year the additional film-handling facilities actually available at Ealing brought the total number of film dubbing theaters in the London area to four. The total number of film review theaters was seven, and 40 cutting rooms were available. It is expected that considerable additions will be made to these facilities during the coming year. Three film stages are in regular use at Ealing and there is also a comprehensive exterior set. A film caption and animation room has also been started.

Eurovision. The exchange of programs between Great Britain and other European countries increased during 1956 to an average of four programs a week passing across the English Channel. From London to the Channel coast a permanent coaxial cable link was installed by the British Post Office in September 1955, and the Post Office will have permanent radio-link equipment operating across the Channel to Cassel in France by 1958. Meanwhile, the BBC and Radiodiffusion-Television Française are jointly operating their own cross-Channel microwave radio links. Ten European countries are now connected to the Eurovision network, the more complicated programs being coordinated by the European Broadcasting Union at its center in Brussels, Belgium.[151]

Largest British Tungsten Filament Lamp. The largest tungsten filament lamp made in the country has been manufactured by the British Thomson-Houston Co. at a research and development cost of over £10,000. Designed for film studio lighting, the new 20-kw lamp will be used in making color films.[151]

cameras employing a network of fine

the partially completed permanent tower.

Each studio has a large number of

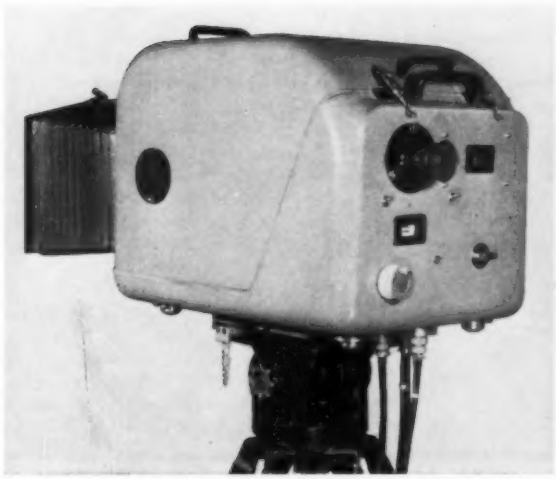

Fig. 35. Double-film, combined sound and picture camera with blimp closed.

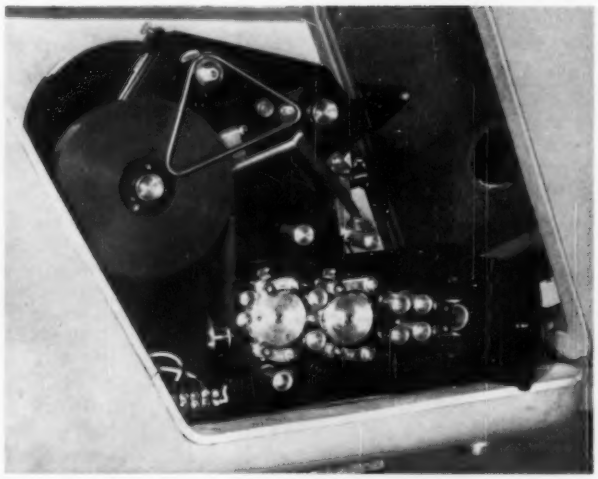

Fig. 36. Double-film camera showing sound recorder with 35mm film in place.

New Film and Processing Developments. Black-and-white picture negative-emulsion characteristics in 1956 have moved further in the direction of finer grain, without change of speed. Ilford introduced FP3 negative film, having a Weston speed of 80 to daylight and 64 to tungsten, and an improved faster version of Pan F emulsion. This new film has a Weston speed of 24 to daylight and 16 to tungsten, representing a 60% increase in speed with the same sharpness and grain characteristics.[151] Kodak Limited commenced manufacture in England of the new Plus-X Type 4231, and the higher speed Tri-X Negative, and, in the field of color, Eastman Color Negative Type 5248. Among new 16mm films were Kodak Plus-X Type 7276 and Tri-X Type 7278 reversal materials, already available in America but manufactured for the first time in England. Gevaert introduced two new 16mm reversal films, TV.086 and TV.081 of low contrast, specially designed for the TV market. Gevaert also announced a new extra high-speed negative film, Gevapan 36, having a speed of 36° Scheiner.[152]

A new double-film combined sound and picture camera has been developed by Rank Precision Industries Ltd., and the BBC. It consists of an Eclair "Cameflex" camera together with a specially designed magnetic-sound recorder, mounted in a soundproof blimp. Both camera and sound recorder can handle 35mm or 16mm films (Figs. 35, 36)[153]

Gaumont-Kalee introduced a double-frame VistaVision projector of entirely new design (Fig. 37).[153]

TV Developments in Europe

Television in Europe, above all in Great Britain, Germany and France, has grown rapidly[154] in the past year. The smaller countries have difficulties with the introduction of TV. The means for installation of studios and transmitters on a large scale are too small; the number of televiewers is rising too slowly to finance the installations in time. The finances for TV in Europe are got in most cases not by sponsored transmissions but by contributions of televiewers.

The increase of the number of televiewers is great at times when interesting programs are shown. This was the case during the Olympic winter games in

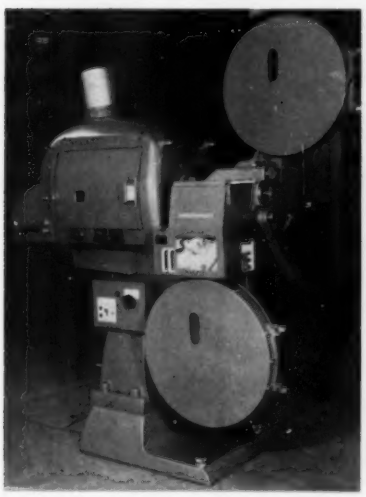

Fig. 37. Gaumont-Kalee double-frame VistaVision Projector.

Fig. 38. Front view of Marconi Transmitter Control Desk during installation, ITA TV Station at Emley Moor, England.

Fig. 39. Small TV camera for outdoor broadcasting purposes, Compagnie Général de TSF, Paris.

Cortina d'Ampezzo, Italy. There are about 1,000,000 televiewers in Russia.[155] Programs there were delivered in summer 1956 by 15 television centers.

The technical progress of TV in Europe in 1956 showed some interesting points.[156]

TV Transmission. A second program company, the Independent Television Authority (ITA), has been inaugurated in Great Britain. The studios and transmitters are built with the most modern apparatus (Fig. 38). The radiated power of ITA's London TV transmitter has been doubled. The special equipment for this doubling was made by Marconi.

An interesting small equipment for outdoor TV broadcasting has been developed (Fig. 39). It can be carried by the camera operator. The TV signals must get only small distortions on their way from the camera to the transmitter. Means to reduce these distortions have been investigated.[157]

We draw attention to a system for handling TV at the transmission path by an intermediate frequency of 21 mc/sec.[158]

Television Reception. Several methods have been developed to heighten the quality of the picture received; e.g., pulsed automatic gain control[159] and tuning indication.[160]

Receivers for more than one television standard were further improved. The picture tube also got improvements.[161] Flat picture tubes were brought nearer to realization.[162]

The means for reduction of disturbances[163] are important for the improvement of television reception as well as the registration of television transmissions.[164] Apparatus for taking 16mm motion pictures of the TV screen as shown in Fig. 40 have been developed. The quality of the reproduction is excellent.

Color TV. Great efforts have been made to realize color TV in Europe.[165] Several possibilities and the quality of the received color and black-and-white picture have been investigated.[166,167] It seems that it will be possible to combine the American NTSC-system for color TV with the CCIR TV standard with 625 lines,[168] which is used in Europe. An interesting flat picture tube for color television[169] has been discussed. Philips have built an installation for the transmission of color slides (Fig. 41).

Industrial TV. Pye have practiced for many years underwater TV. This company has developed a new camera (Fig. 42) for this work. We mention among the many new uses of industrial TV that Pye Ltd. has designed a special camera for use inside the atomic reactor. In connection with television developments in Europe we remember Prof. Schröter (Fig. 43), to whom we owe many contributions to the modern state of TV and who celebrated his 70th birthday on December 28.

Report From The Far East

Overall progress in Asian motion-picture industries moved ahead dynamically, spearheaded principally by Japan but reflecting tangible improvement in economic position of virtually all Far Eastern nations. Marked by expanded quantity and improved technical quality of productions, and extension of exhibition outlets, the year's overall industry gains can be attributed in large degree to demands of the common man for more

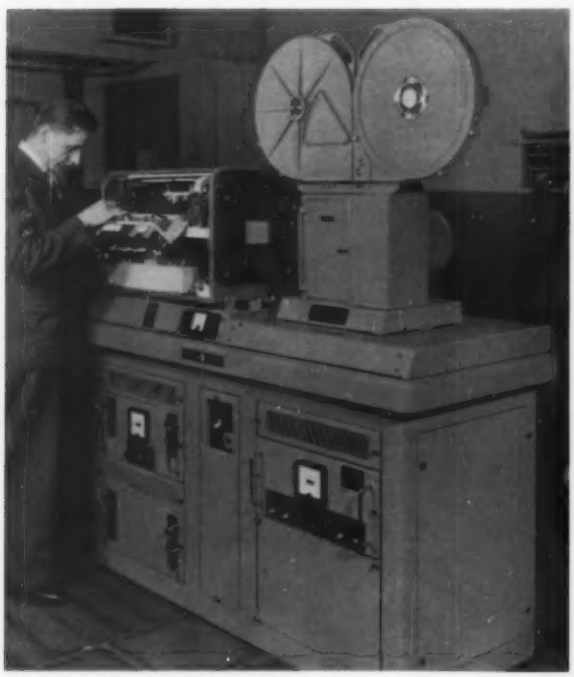

Fig. 40. Marconi TV recording equipment for 16mm film, showing accessibility for servicing.

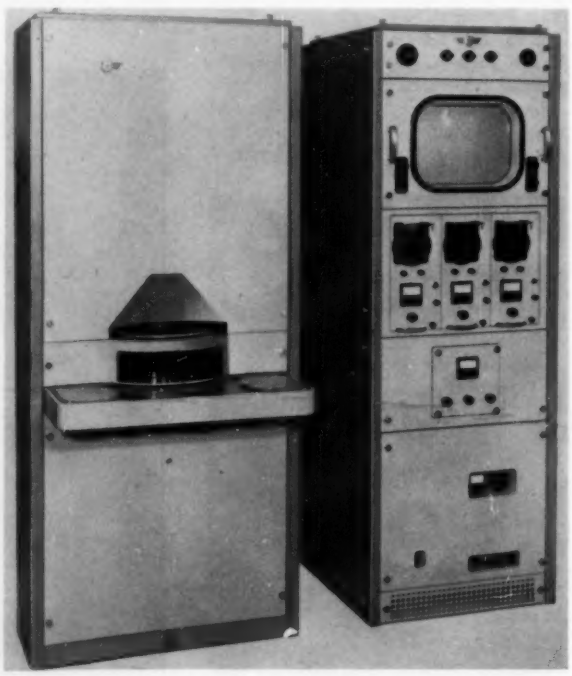

Fig. 41. TV transmission equipment for color slides, Philips, Eindhoven, Holland.

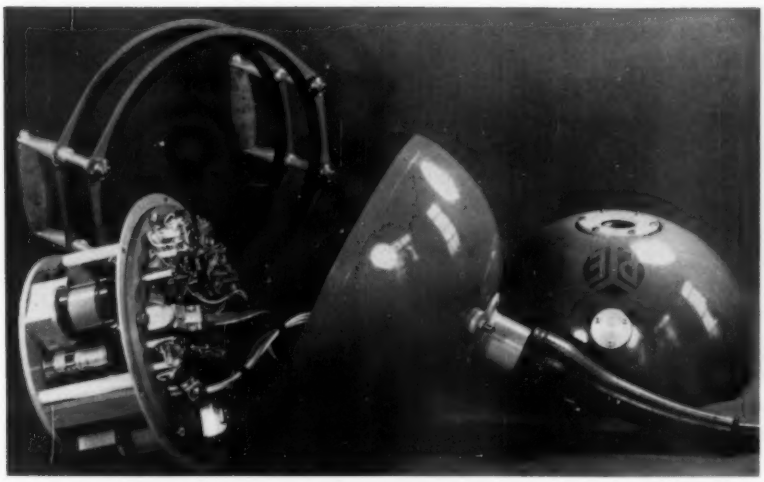

Fig. 42. Hand-held underwater TV camera with handles and spherical casing removed, Pye, Cambridge, England.

recreation and entertainment, and increased ability to pay for these creature comforts. Important film festivals were held in both Hongkong and Manila, while other Asian trade centers gave increasing recognition to growth of their domestic motion-picture industries. In turn, Hollywood paid tribute of its cognizance to increased importance of the Asian market when, in September, the Academy of Motion Picture Arts and Sciences announced establishment of a permanent "Oscar" award for the Best Foreign Film of each year, upgrading the earlier and more restrictive honorarium bestowed upon the best foreign film released in the United States, and chose Toho Company's *Samurai* as the top foreign feature for 1956.

Japan. The past year marked the 60th anniversary of the founding of the film industry in this country, feted by the first annual "Movie Day" held December 1 in Tokyo. Progress throughout the Nipponese industry, broadly covered in last year's *Report*, enjoyed accelerated expansion in all phases. Total production from all Japanese studios reached the world's highest figure of 509 features, of which 28 were in color (principally Eastman stock). Three hundred and twelve newsreels and about 600 shorts and documentaries also were released. Theater construction was widespread throughout the Japanese home islands increasing the total in active use to over 5600 including some 58 new deluxe showhouses, a number of which incorporate two to four individual theaters under one roof, constructed in principal urban centers in this country where drive-ins are unknown. Estimated gross attendance for the full year exceeded 1.01 billion admissions with total box-office receipts topping 70 billion yen ($195 million) for both domestic and import product release; 104 features from U.S. majors; 48 from other foreign sources. Using a national population figure of 90 million as denominator, this indicated that the average Japanese patron attended film theaters 11.3 times during 1956. All statistics excepting for segregated grosses derived from import film exhibitions, registered industry gains ranging from 10% to well over 20% as compared with the prior year.

Exhibition House Progress. A large percentage of over 600 new theaters constructed show striking originality of design and clever space utilization and adaptation to plot lines. Bowing in as the year began, the "OS" Theater in Umeda, Osaka, was designed specifically for exhibition of Cinerama, with its side projection rooms incorporated into each auditorium side wall to avoid any sightline interference or seating-area limitations usually encountered in theaters converted for that process (Fig. 44). Other imposing designs included the Fukuoka (Kyushu) Asahi Kaikan with two theaters; Shochiku's home-office edifice in Tsukiji, Tokyo, with four houses under one roof headed by the import roadshow "Central" Theater; the imposing Tokyu Bunka structure also with four theaters in Shibuya, Tokyo, and the same company's "Milano-za" coupled with a smaller theater in Shinjuku, Tokyo.

Most particularly impressive by virtue of their design, believed unique in the world through application of ultra-modern concepts based upon ancient Greek Amphitheater architectural forms, are the two new Koma Stadium theaters, respectively erected in the Umeda amusement center of Osaka, and the Kabuki-cho area of Shinjuku, Tokyo. "Koma" means a child's spinning top in Japanese language, which symbolizes the

Fig. 43. Prof. Schröter (left), a well-known television pioneer who was 70 years old in 1956, speaking with Prof. Nestel.

highly interesting multiple circular stage structure comprising the central showcase area. Three sizable concentric performance rings supported by a massive steelwork frame extending down to foundation piers, are flexibly mounted to permit independent raising or lowering of each ring above or below normal stage level while simultaneously allowing revolution of any ring in either direction (Fig. 45). Individual elevator platform traps disposed in equidistant locations within the rings enable individual stars or small performer groups to be brought quickly into or removed from audience view. The Koma stages may be concealed by a full circular contour drape curtain backed by more conventional side draw main curtains. Sound reenforcement systems installed in each Koma Stadium are the most elaborate ever developed in Asia, consisting of 3-channel stereophonic types controlled from 13-channel mixing consoles. All stage production musical accompaniment is pre-recorded on 3-track magnetic tape; while all star performers utilize miniature lapel microphones feeding costume-concealed transistor transmitters whose radiations are demodulated by fixed receivers located in the stage wings and channeled into the re-enforcement system with excellent fidelity and effectiveness.

Koma Stadium theaters are the first in the Orient to have been equipped with Philips Todd-AO 7/35mm projection and multichannel magnetic sound, Peerless Hy-Candescent arclamps, and simultaneously initiated showings of *Oklahoma* in Todd-AO on December 28. Screens and frames were especially fabricated by Yanagiya Sound Company, Ltd., of Tokyo; the screen installed in Umeda Koma has reflective dimensions of 30-ft height by 65-ft width, curve-mounted to maximum depth of 13.5-ft; while that employed in Shinjuku Koma is a tremendous 35.3 ft by 84.8 ft, a chord span approximating 72 ft and depth more than 19 ft, and probably is the largest Todd-AO process screen in the world today (Fig. 46).

Fig. 44. Interior view of "OS" Theater, Umeda, Osaka City, showing left-side projection room as installed on side wall of first balcony without interference to seating and sightlines.

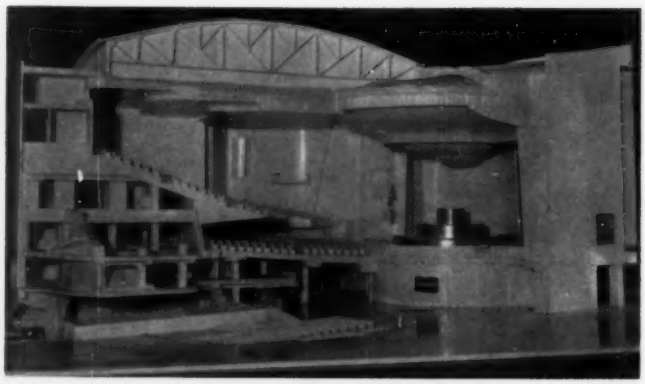

Fig. 45. Cross-sectional model of Umeda Koma Stadium showing relationship of circular stage (in elevated positions) to seating areas.

In each Koma Stadium, nearly half of the circular stage extends outward into normal forward seating zone, while the seating pattern radially surrounds the extended stage over 160° in included arc. Umeda Koma seating totals 2044 chairs almost evenly divided between main floor and one balcony; while Shinjuku Koma has 2894 chairs installed on true stadium slope. The forward seating patterns described are predicated upon maximum audience disposition for stage presentations only, and usable seating area for satisfactory viewing of Todd-AO process projection necessarily is reduced by several hundred spaces in each theater (Fig. 47).

Projection and Sound Equipment. Virtually all 35mm projectors of Japanese manufacture are nonenclosed designs of open-running mechanism after continental practice, and in this field, essentially no improvements were reported. Mid-year expectations of trade introduction by Fuji Precision Machinery Co., of their new fully-enclosed self-lubricating projector went unfulfilled as the prototype models, designed after American pattern, were returned from limited field tests to the company laboratory for further simplification and cost reduction to meet competitive market levels.

First employment of 16-in. diameter elliptical reflectors was marked by their inclusion in Japanese design and limited production of a simplified high-intensity arclamp introduced early in 1956 under the "Nikkyo" label of Nippon Onkyo Seiki of Osaka, whose product was designed for 9mm copper-coated positive carbons operating at 90 amp. A departure from the universal design and production in this country of simplified high-intensity lamp types was begun in September by Tokyo Aircraft Instrument Co., makers of "New Star" projectors and lamps, in introducing their Type V rotating positive reflector lamp model (Fig. 48). Although broadly influenced by American rotating positive-reflector lamps imported for the two Cinerama exhibition houses in Japan and for some of the largest Army and Air Force Theaters in the Far East, the local product, nevertheless, exhibits considerable independence of design in its positive-carbon transport mechanism and in the steep angular mount (75°) used for the negative carbon. This lamp also employs a 16-in. diameter reflector having light collecting angle of 140° and working distance factors resulting in magnification factor of 6, and $f/2.15$ speed. Although the new lamp is represented as having been designed for various diameter carbon-trims to permit an operating range from 85 up to 120 amp maximum, in the comparatively few installations made in 1956 these lamps have been limited to 90 amp, due to factors related to stable operation.[170]

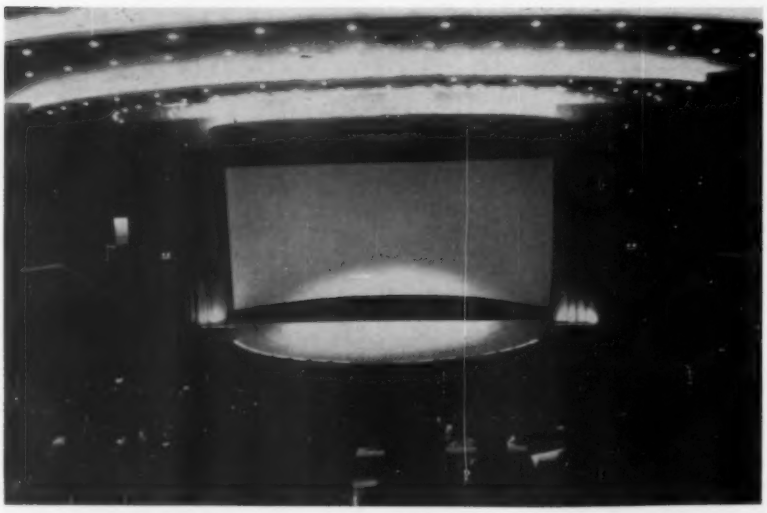

Fig. 46. The Todd-AO process screen installed in the Shinjuku Koma Stadium Theater, Tokyo. Its dimensions, approximately 35 ft by 85 ft, probably make it the largest in use in the world for the particular exhibition process.

At a Tokyo trade showing held in late November in conjunction with the Japan Audio Fair, preview was offered of a new commercial semiautomatic projection and sound-control system. Based upon fundamental design earlier developed for Far East military theater circuit modernization,[171] Tokyo Theatre Supply Co. sponsored the new product upon which prime exploitation effort will be emphasized to counter developing shortage of qualified projectionists brought about by mushrooming expansion of Japanese exhibition houses and consequent increasing demands for skilled operational personnel. This system design provides individual compact pushbutton control boxes for mounting on each projector pedestal; all power relays and timing-circuit components for control of arc supply sources, projector motors, douser change-overs and exciter-lamp sound switching are neatly grouped in a separate wall-mounting cabinet to enable maximum flexibility and servicing access for incor-

Fig. 47. Sectionalized model of Shinjuku Koma Stadium, Tokyo, showing disposition of seating in relation to circular stage area and Todd-AO process screen.

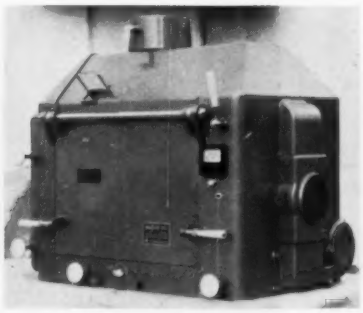

Fig. 48. "New Star" Type V rotating positive high-intensity arc lamp, product of Tokyo Aircraft Instrument Co., Ltd., is the first of this type to have been designed and produced in the Orient.

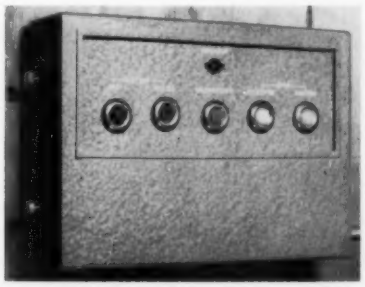

Fig. 49. Individual projector pushbutton control for Tokyo Theatre Supply semiautomatic projection and sound-control system.

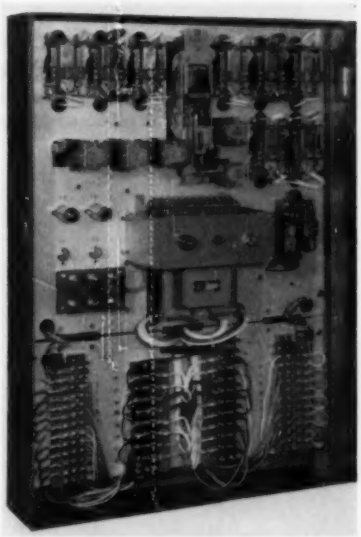

Fig. 50. Wall-mounting cabinet, containing all power and timing controls of Tokyo Theatre Supply semiautomatic projection control system.

poration with existing as well as new equipment installations (Figs. 49, 50).

Sansha Electric Manufacturing Co. of Osaka extended the application range of their line of selenium arc rectifiers with addition of a new 200-amp output model for the export drive-in theater trade, at behest of their American importing distributor (Fig. 51). This manufacturer also doubled production capacity with added plant facilities and an improved and enlarged design of semiautomatized selenium element deposition equipment, in response to greatly increased export business demands from the 2 American continents as well as expanding distribution of its products throughout Asia (Fig. 52).

The principal Japanese film sound-equipment manufacturers introduced new designs of both 3-channel optical track and 4-channel magnetic track equipments during 1956. While no radical innovations resulted, each line revealed increased attention to orderly design and neat appearance, improved component quality and layout, and ready service accessibility.

Prominent among these lines were Photophone Models PG-310, PG-330 and PG-350 from Victor Company of Japan, Ltd.; the Nippon Electronic Industries Corp. Neicor line, which exhibited design influence from British Gaumont-Kallee; the Royal line of Komitz Industrial Co.; and Tachimori Electric Co.'s Apollo sound. The two Asian manufacturing licensees of Perspecta equipment, Victor Company of Japan and Komitz Industrial, each gained expanding market acceptance of their respective production of Integrators and in late November, the Victor Co. introduced their latest model PAM-8004-C to the domestic trade, which incorporates design improvements including effective simplification of channel carrier-filter circuits (Fig. 53).

The greatest tangible improvement in production models achieved was evident in the reproducer-equipment field, wherein earlier Japanese-made products admittedly have been weakest against foreign manufactured competition. Spurred by rising Oriental market interest in high-fidelity audio reproduction, all principal loudspeaker manufacturers carried out production resulting from intensive research and application of improved materials and design practice. Manufacturers scoring impressive improvements in this field were Hazama Electric; Matsushita Electrical Industries; Nippon Electronic Industries Corp.; Tokyo Shibaura (Toshiba); and Victor Company of Japan, Ltd. (Fig. 54).

Extending the field of previously recognized quality optical manufactures of Japanese origin, was re-establishment by Fuji Photo Film Co. of an optical products department which introduced superior new designs of master projection and prismatic anamorphic lenses under trade label of "Fujinon" (Fig. 55). Improvements in optical speed and quality as well as product uniformity were registered in the "Proskar" line of Keihan Optical Instruments, and the "Prominar" brand from Nippon Denki Kogyo.

At year's very end, preliminary announcement was released by the Shiga Brother principals of Nihon Lens Kogyo Co., of successful development of a process termed "Solid Cinema." It was represented as requiring a "solid projection scope" of their design installed in front of a conventional lens to project image subjects onto a solid screen mounted opposite one spherical in surface. Results are claimed to induce much the same effect of depth illusion upon the human retina as direct subject viewing. Further details and evaluation of process merits were not available for this report.

Production. Among all Japanese producers, six companies accounted for 98.8% of the 509 features released. Toei took the lead with a total of 106, 5 in color. That studio was followed by Toho with 94 but all black-and-white; Shochiku released 86 including 5 color; Daiei closely followed with 83 but topped others by including 9 releases in color, in which field they were pioneer producers in Asia; Nikkatsu produced 79 features including 3 tints; while Shintoho labeled 54 black-and-white and 1 color releases. Small independents produced the remaining 6 features, 1 of these in color.

Total estimated raw-stock consumption was placed at 295 million ft, up an estimated 2% over the previous year. Breakdown figures between black-and-white stock and color footage were not obtainable but a ratio of 95% to 5% appears reasonably indicative and even so, represents considerable gain for color film. Virtually 100% of black-and-white stock was of domestic production; essentially all color negative and internegative footage was imported Eastman stock, although some import features were printed from internegatives to Fujicolor stock for release distribution.

Fig. 51. A pair of Sansha Electric Mfg. Co. "Stedyfier" selenium arc rectifiers, rated at 200-amp output, for drive-in application.

Fig. 52. Intermediate assembly testing stage for production of Sansha selenium arc rectifier units being prepared for export.

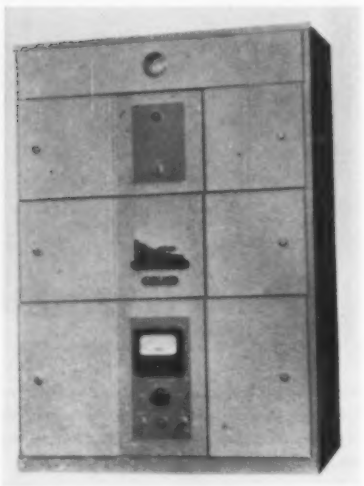

Fig. 53. Model PAM-8004-C is the latest series of Perspecta Integrator and Power Supply by Victor Co. of Japan, Ltd., introduced for domestic and export outlets late in 1956.

Fuji Photo Film Co. completed 100% conversion of its manufacturing facilities to tri-acetate safety-base support for positive release stock and at year's end had achieved production capacity of ½-million ft/month, with additional plant capacity under construction to double this output by the following Spring.

Within limitations imposed by stringent government controls on imports from the dollar area, several major producers added new Mitchell cameras and scene projection equipment as well as color production lighting sources to their studio production facilities, with Daiei the first to import VistaVision cameras.

Toei was reportedly mulling major decision to film the majority of its productions in squeeze process comparable to the M-G-M Panavision system (but retaining 35mm negative) with partial image compression in lensing, additional in printing; also, to converting exhibition outlets exceeding 500 under their owner/lessor control for 2.35:1 aspect ratio projection. While this major undertaking appeared probable, final executive approval was deferred.

Shochiku made some experimental short subjects with optical directional soundtracks employing a new Perspecta control-dubbing console developed and furnished by Nippon Onkyo Seiki, and also was reported considering purchase of camera and printing equipment for wide-negative filming of top-budget productions, but again, no policy decisions had been announced by year's end.

Construction of facilities for Tokyo Film Laboratory, Ltd., was completed in suburban Chofu where the all-new processing plant opened in May to meet laboratory needs for Asian producers, especially in the color field which previously had been bottlenecked severely. Completely equipped with latest processing and printing facilities imported from West Germany (Arnold & Richter) and America (Bell & Howell), the plant reportedly is equipped for monthly capacity up to 1½-million footage.

Foreign Unit Production. Attesting to further increase of worldwise interest in Japan, its people and natural scenic beauties, over half of the major American producers filmed complete productions or major story sequences on location in Nippon during 1956. Color negative was employed for the majority of these lensings which included use of CinemaScope, Todd-AO and Cinerama process cameras.

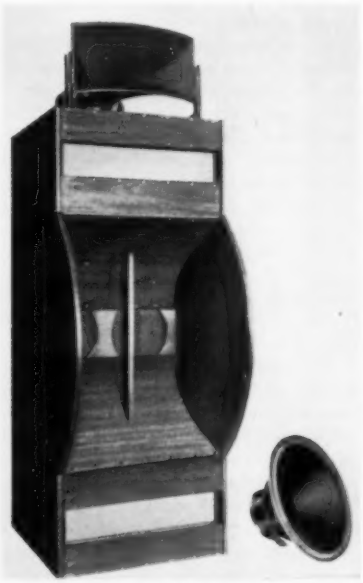

Fig. 54. PL-330 loudspeaker system, developed by Victor Co. of Japan, Ltd., is typical of improved stage reproducers developed and marketed in 1956.

16mm and 8mm. Notable progress was registered in the field of camera and projector equipment manufacture for substandard film gauges and this marked the initial year of any Japanese equipment produced for 8mm film. Hokushin Co. of Tokyo, and Elmo Co. of Nagoya, marketed all-new 16mm sound projectors under their respective company names, each of which was available for magnetic-track sound reproduction as well as optical. Total production of both makes of 16mm projectors, offered in several optional models, was placed at 3500 units for the year, with Hokushin accounting for 57% of the entire output (Fig. 56).

Fig. 55. Typical "Fujinon" master objectives and the "Fuji" variable ratio prismatic anamorphoser, introduced during 1956. The latter is the only anamorphic lens of its type made in Asia.

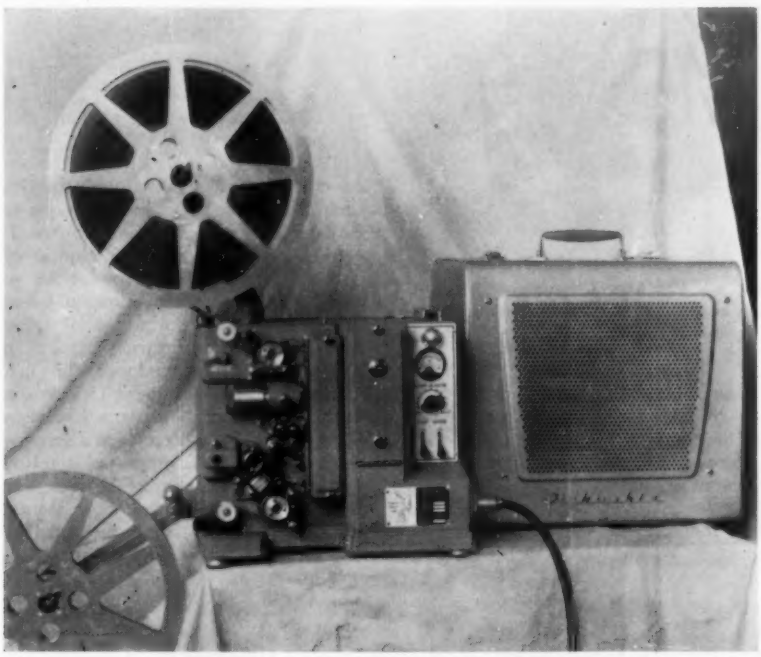

Fig. 56. The new Hokushin 16mm sound projector, introduced during 1956, provides optional reproduction from either striped magnetic or conventional optical soundtracks.

Elmo scored an Asian first with a new triple-lens turret camera design incorporating magnetic-track recording but did not achieve extensive production of this.

Development and introduction of some six different brand labels of 8mm cameras and three 8mm projectors bore testimony to faith in, and judgment of, ascending Asian market opportunities as well as general upturn of national economies. Elmo offered its single-mount interchangeable lens model 8-AA and Atlas Optical, its Atlas-8 (Fig. 57). The Canon Camera Co., makers of 35mm miniature still cameras, introduced the Canon-8 single, and 8-T (Fig. 58) double-turret cameras together with the Canon-8 projector (Fig. 59). Cinemax-8 is an additional double-turret camera

Fig. 57. Atlas-8 camera, product of Atlas Optical Co., Ltd., Japan.

Fig. 58. Canon 8-T double-turret camera.

offering (Fig. 60), while Cine Moviex (Fig. 61), and Arco-8 are both triple-turret cameras, the latter featuring an adjustable variable shutter (Fig. 62). All of these cameras are of spool film-loading designs. In addition to Canon, both Elmo and Cinemax labels (Fig. 63) were on their production 8mm projectors.

Elmo registered another initial entry into the field with its neatly designed Models EM-80 and M-80 8mm magnetic-sound projectors, the EM-80 (Fig. 64) including recording facilities in addition to playback reproduction for both models. Separation of physical disposition of projector aperture and the magnetic track recording and reproducing heads follows the proposed SMPTE standards for use with this film gauge. While these models were developed and announced by Elmo with demonstration of production prototypes, volume production is scheduled to begin in 1957.

Domestic production of 16mm black-and-white film footage was placed at

Fig. 59. The Canon 8mm projector, designed to complement the 8mm camera model shown in Fig. 58.

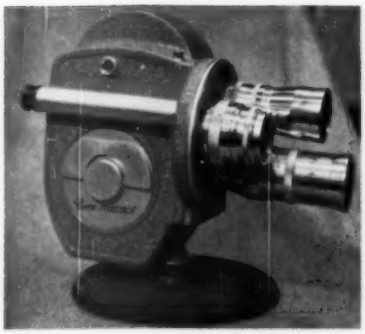

Fig. 61. The triple-turret Cine Moviex, another Japanese 8mm camera designed and initially produced in Japan during 1956.

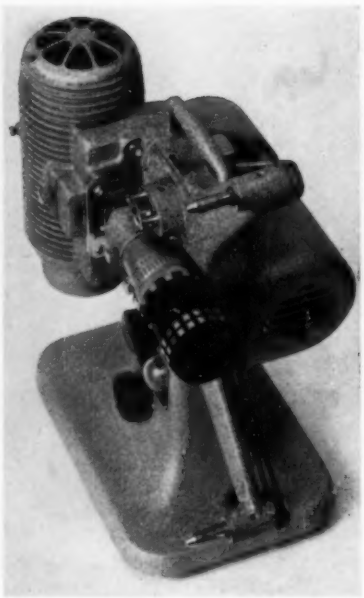

Fig. 63. The Cinemax Model 8-K projector, shown here fitted with a locally produced anamorphic adapter coupled to the objective lens.

Fig. 60. Cinemax-8 camera, one of two brands which introduced double-turret 8mm cameras of Japanese manufacture on the domestic market during 1956.

Fig. 62. The Arco-8 camera, with manually adjustable variable-shutter and triple-turret lens mount.

156,398 sq m or roughly 10 million lineal ft for the year, of which total an unreported percentage was slit and spool-packaged for the 8mm trade. However, color production in the substandard gauges was negligible, since mass volume is still relatively low and production costs high so as to price color stock in substandard gauges out of reach of the amateur market.

Television. Notable mileposts of progress achieved during 1956 included the completion of microwave link-extensions from the main island of Honshu to the southwestern island of Kyushu, and to the northern island of Hokkaido, with slave transmitters established to service the Hakata area of Kyushu out of Fukuoka City; Tohoku area of Honshu out of Sendai City; and central Hokkaido out of Sapporo, for the government-sponsored Nippon Hoso Kaisha (NHK: Japan Broadcasting Corp.); and also by addition of some independent TV outlets in the three major Honshu cities of Tokyo, Osaka and Nagoya. By the end of the year, Tokyo viewers had their choice of one government and two independent channels, while Osaka and Nagoya each had one government and one independent selection. The independent NTV (JOAX-TV) was regularly tieing in with the OTV in Osaka and CBC in Nagoya for a second intercity program chain.

Technical standards of these broadcasters are good, attributable in part to their general use of quality American or British-made camera chains, and American TV transmitters for the majority of outlets, but Japanese manufacture of studio and transmitting equipment based upon foreign designs was showing rapid progress. Shibaura Electric (Toshiba) in Tokyo successfully produced the first Japanese professional studio TV cameras based upon American designs. Hokushin Company of Tokyo developed a successful 16mm film TV projector as initial Japanese product venture in this field (Fig. 65). NHK initiated experimental work with color TV late in the year.

Several prominent electrical manufac-

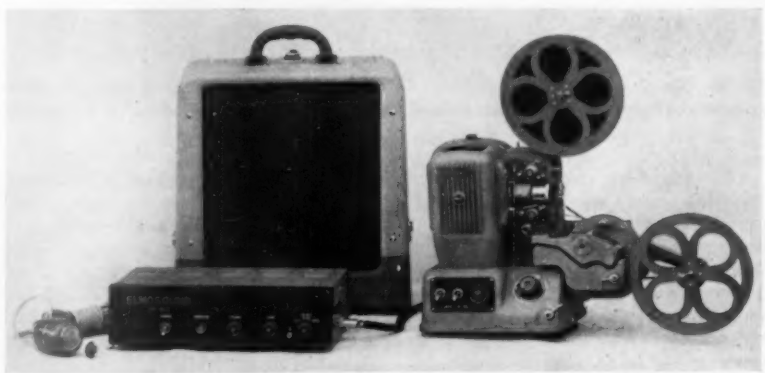

Fig. 64. Elmo EM-80 recording-reproducing 8mm magnetic-sound projector.

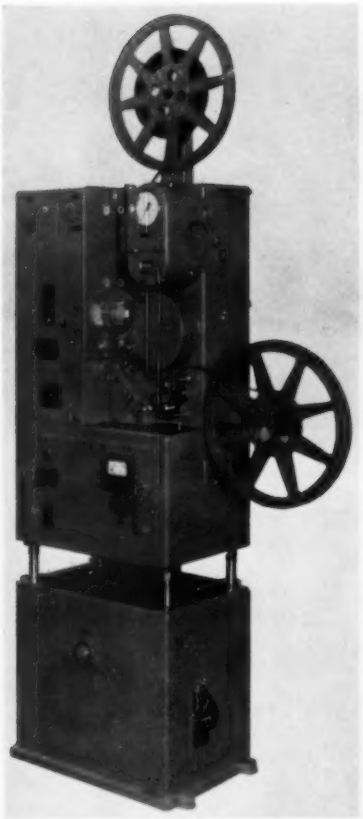

Fig. 65. The Hokushin 16mm film TV projector, the first such product to have been designed and produced by a Japanese manufacturer, Hokushin Co. of Tokyo.

turers produced successful designs of closed-circuit camera chains for industrial applications, including Toshiba, Hitachi, and Matsushita Electrical Industries.

More than a dozen brands of domestic manufactured receivers are offered on the Japanese market, the majority of which provide highly satisfactory image and sound reproduction, and progress was scored during the year in reducing pro-

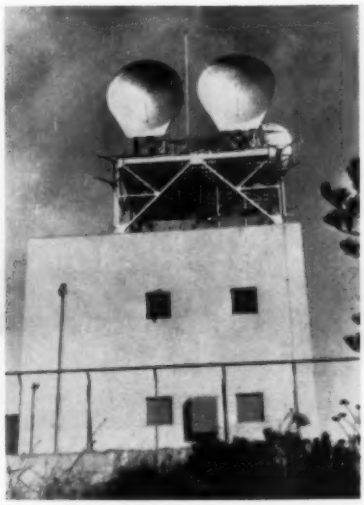

Fig. 67. Typical unattended microwave repeater station between Tokyo and Sendai, completed in 1956.

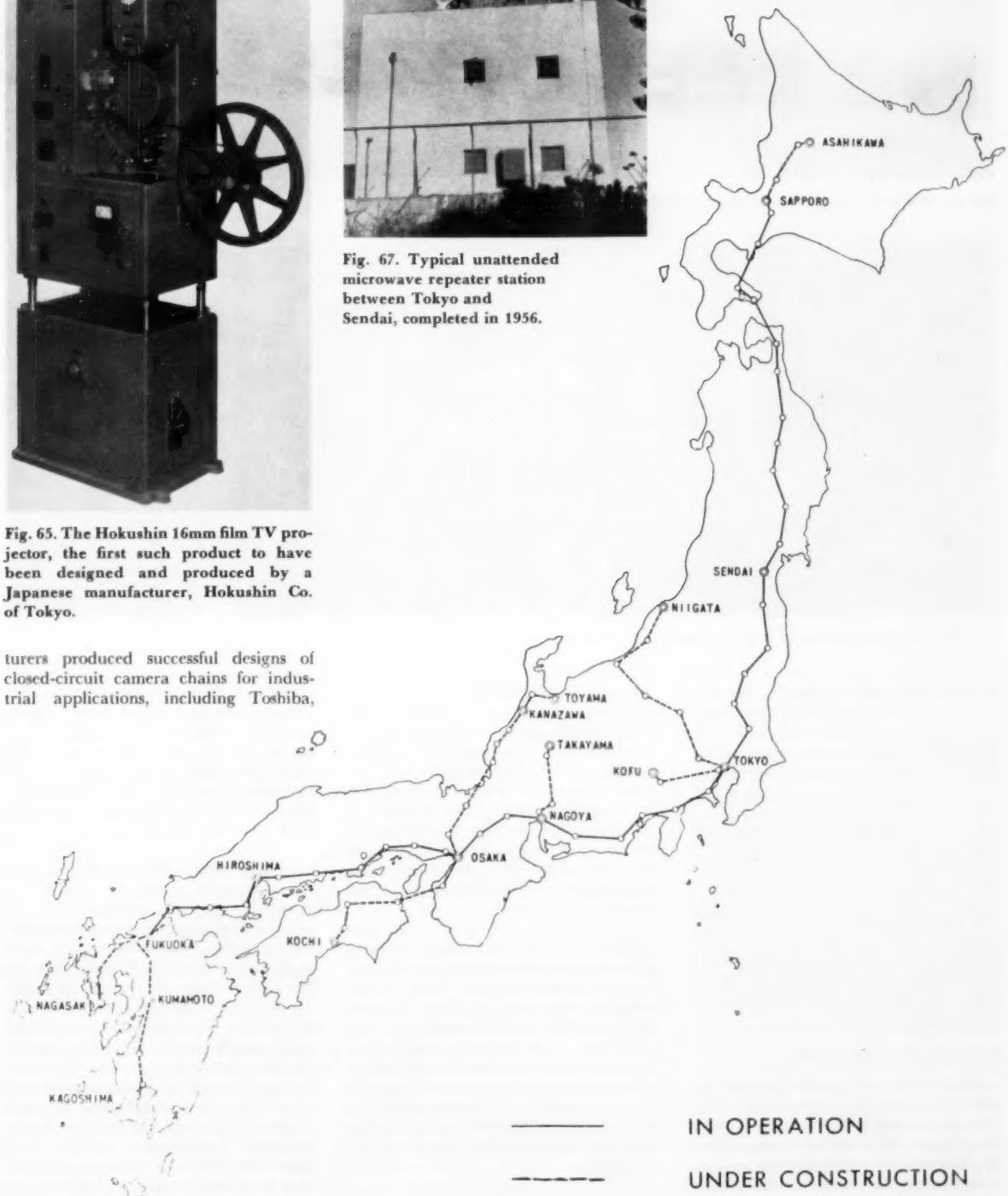

Fig. 66. Microwave relay systems in Japan, Nippon Telegraph & Telephone Public Corporation, Dec. 1956.

Fig. 68. Make-up department, Moscow Film Studios.

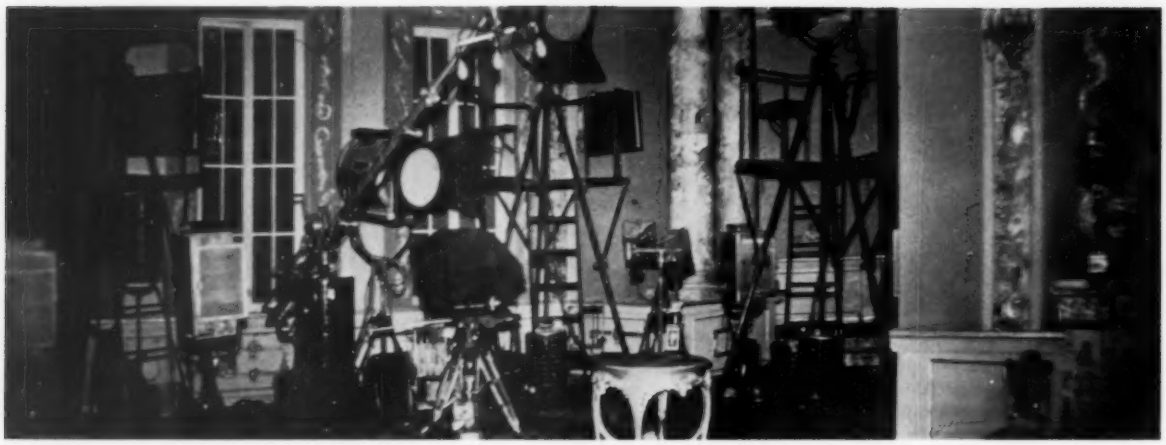

Fig. 69. Equipment on sound stage, Moscow Film Studios.

duction costs without quality sacrifice. The most popular sizes, in terms of kinescope diameters, are 14 in. and 17 in. although definite trend toward 21-in. and a few 27-in. sets was noted. Nevertheless, interested as the Japanese public may be in TV, the total number of sets in current use is estimated at less than 400,000; the number and location coverage of all transmitter outlets serves no more than half the 90-million population; and the minimum market cost of TV receivers remains well above the means of the average Japanese family, so that television has yet to render serious impact upon the booming motion-picture industry (Figs. 66, 67).

Progress Elsewhere in Asia

While 1956 saw relative progress exhibited to some degree in nearly all Far Eastern nations, in most countries other than Japan, developments were limited to expansion of production and exhibition facilities rather than in the sense of technical discovery or origination of equipment designs.

Republic of the Philippines. All studios made some increases in production releases over the prior year but principally for domestic consumption in Tagalog language. LVN Studios garnered four major awards including Best Picture at the Southeast Asian Film Festival at Hongkong, and was the first Philippine studio to release a wide-screen picture in Eastman color. Theater construction moved forward at steady if unspectacular pace.

Republic of China (Taiwan). Progress registered here was confined to additional theater construction, in which a few notable designs were evolved. The producing industry still is struggling with handicaps of substandard equipment, faulty technical work, and overall lack of capital, and while government interests were reported to be concentrated in study of the problems, no long-range solutions had been offered by the end of the year.

Republic of Korea. Definite progress was made in this country as measured by re-emergence of its domestic production industry which turned out about a score of feature releases. Construction was started on the new Sudo Film Studios with completion scheduled for early in the succeeding year. The Government found access to additional black-and-white laboratory facilities.

Chinese Peoples' Republic. Information concerning the mainland Chinese industry has been extremely limited outside the Red orbit, excepting for gleanings from one Japanese equipment trade mission permitted in Peiping in early November. From that source, the fairly obvious was confirmed that virtual sole dependence has been placed upon Russian manufactured equipment imports for the past several years. No wide-screen processes or equipment installations have been introduced, although interest in them and in general exhibition standards improvement is high. Provided the knotty problems in political and fiscal climates can be mutually resolved, 1956 may prove to have historical importance in marking a turning

Fig. 70. Construction in progress on new studio buildings, Moscow Film Studios.

Fig. 71. View of completed portion of new studio buildings, Moscow Film Studios.

point in possible subsequent restoration of industry equipment and feature product trade resumption between the Asiatic mainland and traditional supply sources in Japan. At least the sample equipment permitted to be displayed in Peiping was eagerly purchased by the conclusion of the showing.[172]

Australia

Television made its official debut on November 6 in Melbourne and the surrounding areas in Victoria. Two hundred and fifty thousand persons saw the official opening of the *Herald-Sun* TV station HSV-7.[173] We need more reports from Australia.

Russia

Two members visited the Moscow Film Studios during May. While there, they attempted to set up a connection for getting a Progress Report from Russia. A partial promise was given but no replies were received to the letters sent after returning home. The Russians were courteous and generous with any information and in arranging a tour through the Moscow Film Studios. A short report is offered from personal observation. At the time of the visit, 22 pictures for theater and TV were in production. A number of these, probably one-third, were in color and CinemaScope format with stereophonic sound. The studio seemed quite complete, down to the wig-making department (Fig. 68). Several sound stages were in operation and at least three rerecording setups were seen, the largest of which was a small theater. The studio was adequately equipped with plenty of lights, booms, sound and other equipment necessary for motion-picture production. All work here was done in 35mm. Original sound was done on magnetic film, 17½mm full-coated on the equipment seen, and the recording equipment was quite similar to that being used in the United States—double-fly-wheel movements. Most of the studio equipment was Russian made, with one exception, Mole-Richardson microphone booms (Fig. 69). Although some of the equipment did not have the finished look, most of it was well made.

Informal advice was that the studio was about 25 years old, and it was somewhat rundown in appearance. Alongside the old buildings, a complete new studio setup was being built (Figs. 70, 71). The new buildings were well constructed and were complete even to air-conditioning for the stages.

A small laboratory for original negative developing and daily prints was run in connection with the studio. Release prints were made in another laboratory which was equipped for processing 35mm black-and-white, and Agfa-color negatives and positives. The processing machines were bottom-drive Russian-built machines, complete with automatic temperature control and automatic replenishing. They appeared in every way to be capable of doing a first-class job if properly operated.

The printing department had Debrie equipment including the latest Debrie color printer. Color film was processed without sound and later magnetic sound-striped by a Pyral magnetic-coating machine. Many of the releases are said to be made in stereophonic sound, and on the set it was noticed that

Fig. 72. National Film Board of Canada, aerial view of new building in Montreal.

Fig. 73. National Film Board of Canada, cutting-room tables.

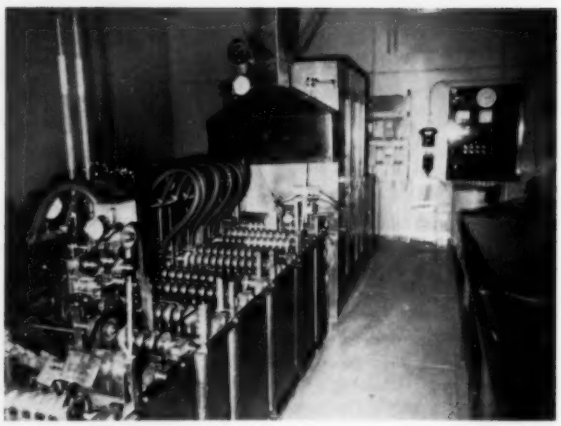

Fig. 74. National Film Board of Canada, light end of the color-processing machine.

the original sound was made in this manner.

In short it appeared that films in Russia are made just as they are anywhere else where good techniques are applied. A most interesting Progress Report could include more about the new studios and equipment now installed. Another attempt will be made to obtain such a report for next year.[174]

Canada

A special report was received from Canada. The report covers the activities of the National Film Board and although this is the first material received on this project, only a modest report will be presented here because several substantial papers from the Society's 81st Convention will appear later in the *Journal*.

During the spring of this year, the National Film Board of Canada moved into its new quarters in suburban Montreal (Fig. 72). The Board is a Government agency whose mission is to render a complete motion-picture service to Federal Departments from original concept through finished film. The building, which was designed by Ross, Patterson, Townsend & Fish of Montreal with John & Drew Eberson of New York acting as consulting architects, was begun in February 1954 and completed in June 1956. It is divided into three subunits, A, B and C Buildings. The A Building houses the Administrative and Distribution offices. At the sides are located the auditorium, the cafeteria, and the health clinic. The remainder of the building is taken up by the Production Staff: e.g. writers, composers, editors, producers.

Building B contains all the facilities for assembling, printing and processing of black-and-white and color films, film-storage vaults, screening rooms, research laboratories, science-film facilities, gen-

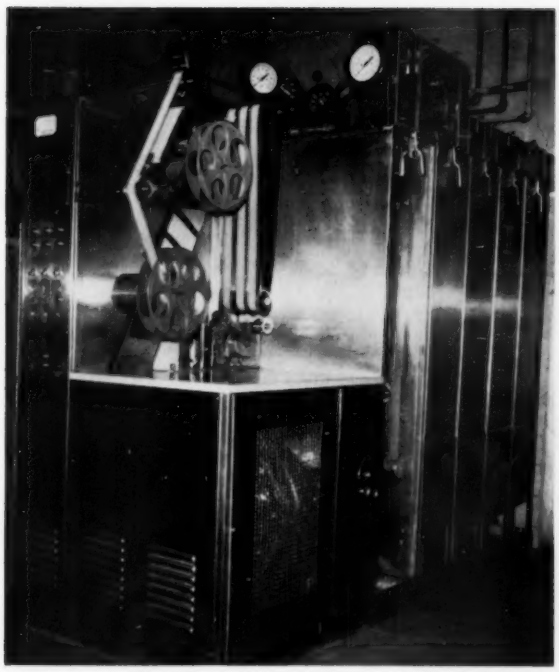

Fig. 75. National Film Board of Canada, combination 16/35mm high-speed spray-processing machine.

Fig. 76. A Saltzman horizontal enlarger for photo murals.

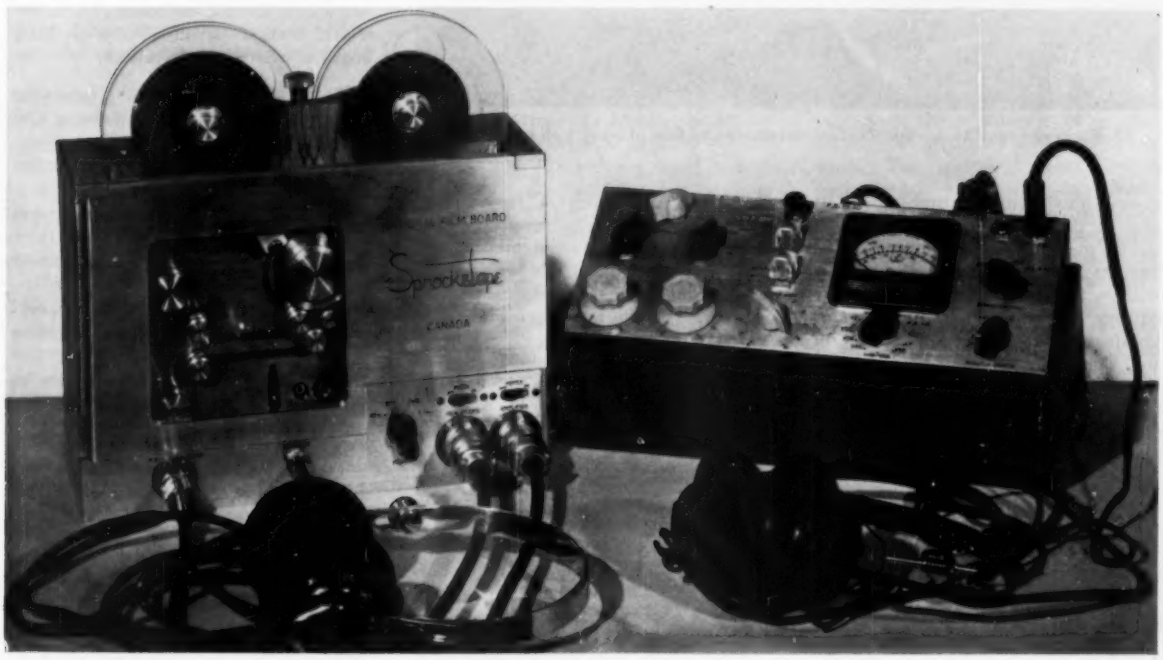

Fig. 77. Sprocketape ¼-in. portable magnetic-sound recorder and amplifier ready for use.

eral stores and complete engineering shops. Building C is the quarters of the camera division, sound division, animation section, filmstrip unit and titling section. It also contains the facilities for those departments, shooting stage, re-recording theaters, scoring theaters and animation camera room.

Major New Equipment and Facilities in the Building. For the various production, editing and cutting rooms, furniture was custom-built in Canada to produce as efficient a working area as possible. Some of this equipment followed closely the patterns existing in the industry while others were severe departures.

The cutting rooms are completely air-conditioned and sprinkler-protected. The lighting and power for each room is independently switched. The cutting rooms are arranged in pairs with an intercommunicating door and a sound-proof door to the corridor.

The benches (Fig. 73) are normally

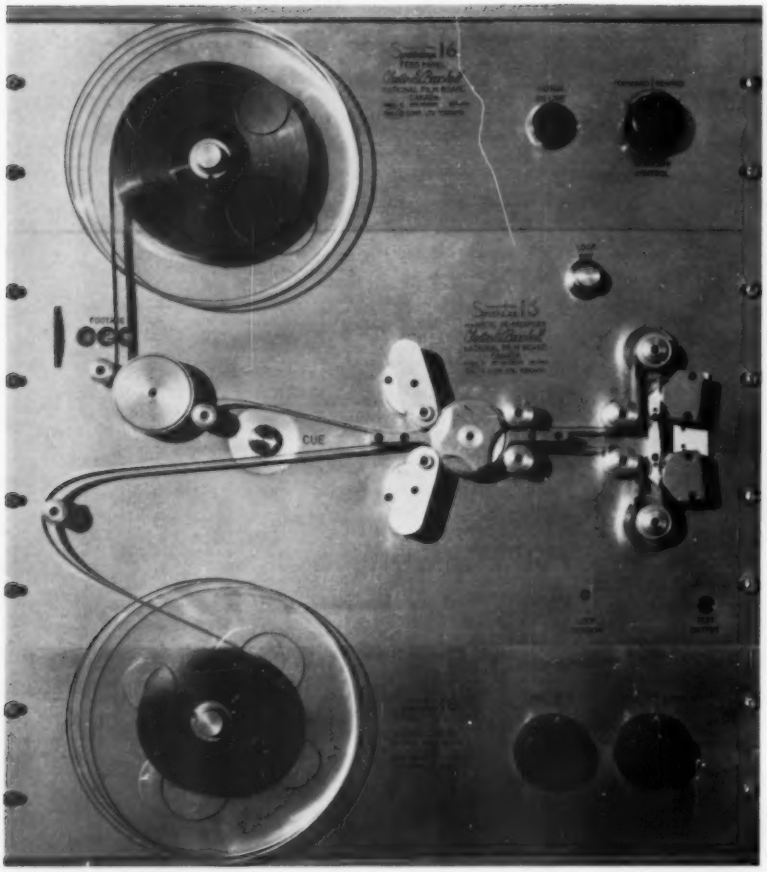

Fig. 78. Rack-mounted 16mm Sprocketape recorder and film phonograph for studio use.

set up with the main cutting table (7 ft long) in the center. On this table the rewinds may be mounted at any of four distances. On either side, are smaller auxiliary tables (3 ft 6 in.), one set up for ordinary rewinding and the other for checking synchronization before dubbing. The benches have telescopic legs to adjust the height of the working surface. The surfaces of the tables have removable inserts over the drop bins so that the units may be used as ordinary tables. One wall outlet services the electrical needs for the complete unit—the editing machine, light boxes, splicer and auxiliary tables. The aluminum triple trough in the center of the picture is sufficiently large to hold all the takes required in the editing of a normal 3-reel 16mm film.

The trim bins and can racks come in both 2 ft 6 in. and 3 ft 6 in. lengths. They are adjustable for either 16mm or 35mm use and the trim-bins bar may be adjusted for the height of the user. Each room is also supplied with a film rack on wheels for transporting the completed picture and tracks to the machine room for dubbing.

A color-processing machine was installed in the motion-picture laboratory. This machine was built in Canada by Dominion Metalwares of Port Credit, Ont., and Salco Engineering of Toronto from mechanical drawings prepared by Ralph D. Whitmore, Jr., of New York in consultation with the technical staff of the National Film Board (Fig. 74). With a view to internal processing of color for the first time, the Board also acquired a Peterson reduction printer with a scene-to-scene color-change device.

Another major acquisition was two high-speed spray-processing machines from Artisan Metal Products of Waltham, Mass. (Fig. 75).

Because of the large volume of TV work filmed in 16mm, the Film Board purchased a new Oxberry Optical Camera with combination 16/35mm projector and camera movements. This item was delivered late in the year.

In the Stills Laboratory custom-built equipment adds considerably to efficiency and the new photo-mural enlarger answers a long-felt need for equipment of this type (Fig. 76).

The cameras of the Animation and Title Photography section were rebuilt during the move and a new Oxberry animation table added to one stand so that there are now three cameras capable of doing full animation work.

Fig. 79. Cinemicroscopy with the Cooke Universal Microscope and Cine-Kodak Special.

Sprocketape Magnetic-Sound Recorder. The Sprocketape magnetic-sound recorder, consisting of two units — a film transport mechanism and an amplifier (Fig. 77) was developed by the technical research section of the National Film Board to meet these objectives:

(1) To provide high-quality recording and reproduction of music, dialogue and effects;

(2) To run in positive synchronism with a picture camera;

(3) To be compact in size and light in weight for handling and shipping;

(4) To operate at low electrical-power consumption;

(5) To be sufficiently quiet in operation to permit use on set with microphone open;

(6) To be of sturdy construction to withstand normal location wear and tear with minimum maintenance.

The prototype machine developed to meet these needs was completed in January 1956. Nine additional units have been used on the National Film Board regular production program in Canada, Europe and South America during the past twelve months with entirely satisfactory results. As a result of the excellent performance of the $\frac{1}{4}$-in. Sprocketape location recorder in the field, a demand has arisen for a similar type of unit to serve as a combination film phonograph and recorder for studio use. A machine for this purpose has been developed for rack mounting. This unit may use $\frac{1}{4}$-in. or 16mm magnetic film, the latter is readily compatible with editing machines, splicers, and other editing equipment (Fig. 78).

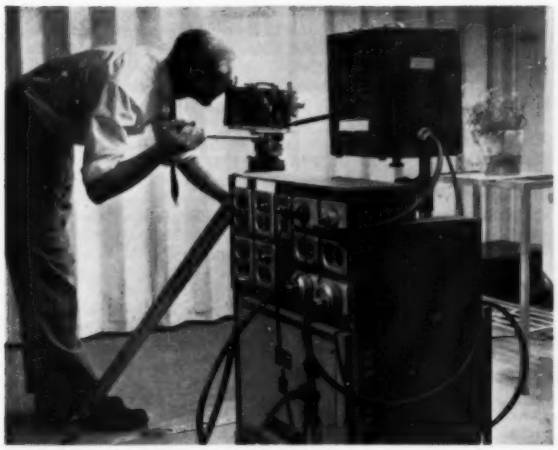

Fig. 80. Shooting time-lapse with Cine-Kodak Special and Rolab Timer and camera drive.

Fig. 81. Checking temperature of Arctic plants overwintering in special refrigeration chamber designed for time-lapse shooting at low temperatures.

Science Film Unit. The Science Film Unit, located in B Building, was organized to make films on scientific subjects, particularly those requiring specialized techniques and equipment such as cinemicroscopy (Fig. 79) and time-lapse cinematography (Figs. 80, 81). In the floor of the greenhouse, a camera pit has been built, one end of which contains a large temperature-controlled aquarium tank for underwater photography.

Associated Screen News Ltd., Montreal. The inauguration of the first Canadian commercial facilities for the printing and processing of 35mm Eastman color negative and positive was announced by Associated Screen News Ltd. of Montreal.

Canadian Broadcasting Corp. The CBC is installing cross-modulation compensators in its variable-area soundtrack printing equipment. These compensators can be cut in or out, depending on the amount of high-frequency distortion to be eliminated or reduced. Cross-modulation testing equipment is also being installed. This will enable CBC to establish and maintain strict photographic control of variable-area soundtracks. Test procedures will, of course, be in accordance with ASA specifications.

CBC is also adopting as standard, the SMPTE magnetic-playback characteristics. The M16MF test film playing back over a 200-mil width head with a $\frac{1}{4}$-mil gap should give a flat reproduction from 50 to 7 kc $\pm$ 1 db when using an injection test circuit. Prior to this, they were unable to use this test film due to the insufficient width of their magnetic head.

Shelly Films Ltd., Toronto. Shelly Films Ltd. report that they have been doing electronic printing, recording each release print from a master magnetic, rather than the conventional method of printing optically from a negative. This method has many advantages over the optical in that all distortion inherent in negatives and printers is completely eliminated. They believe this system unique in that they use two slave recorders from one magnetic playback, all electrically interlocked and running at twice normal speed. Recording is Westrex variable-density using supersonic bias.

They are the first and only organization in Canada to do magnetic striping using the Minnesota Mining & Manufacturing Co. laminate process. By this system, they can securely bond a magnetic track to any 16mm film — either raw-stock negative in black-and-white or color, or any processed stock. The track can be either 30, 50 or 100 mils wide depending on requirements. Prestriped negative and color camera stocks can be shot in magnetic single-system cameras and the stripe is guaranteed safe in any processing solution including strong bleaches in reversal solutions.

The magnetic laminate used, unlike "liquid" type striping-processes, is manufactured by 3M under factory production techniques similar to their regular $\frac{1}{4}$-in. tapes. This insures uniformity of product and complete absence of "edge bead."

Brazil

Motion Pictures. National production of motion pictures increased because the government relaxed controls. A Federal price-controlling agency had previously fixed the price of motion-picture theaters and admissions for many years. Rising costs in the past had made it impractical either to build theaters or produce pictures. Admissions prices now can be established to yield a profit, and motion-picture distributors and producers are further aided by certain tax exemptions and by government-offered prices. In particular those offered by the city Government of Sao Paulo helped aid profits. These improvements spurred the production of 30 features. With motion-picture production in full swing, technical developments, mostly in color photography, are expected in 1957. Through 1956 many laboratories began experimental work in color, some for documentary and promotion films, still others for feature presentation.

The supreme difficulty most studios face is in the acquisition of a proper supply of negative and positive raw stock. The quotas assigned by the Government are insufficient, leading often to black-market activity. Despite these problems, a new motion-picture laboratory was opened in Rio de Janeiro with full capacities for production installed.

In sum, economic facilities for domestic production of motion pictures have improved and for 1957 there is optimism.

Television. Brazil's several privately owned TV stations effected a consolidation during the year to meet the rising needs of over 500,000 people, located for the most part in the Rio de Janeiro-Sao Paulo area.

Already Belo Horizonte, a new station, has begun operations and several more new stations are expected to begin shortly.

TV stations are handicapped technically by the lack of repair parts for cameras and subsidiary electronic equipment. Picture tubes designed for 1000-hr life are used often for 3000 hr. Cameras are also subjected to severe climatic conditions for which they were not designed.

Some items reach studios from local manufacturers, but the small TV industry can not as yet support suppliers. With the new amalgamation of studio

interests this situation may be remedied and the training of qualified personnel, also a serious problem, will be more extensive.

The first TV link between Rio de Janeiro and Sao Paulo was effected in 1956, although the job was accomplished without use of special equipment. Mobile locations were established high in the mountain forests at places selected by air observers, and equipment was trucked both by pack mule and by hand. As a result, the Grand-Prix "Brazil" horse races reached a huge TV audience.

Mobile TV is developing rapidly even in the downtown areas of Rio where high buildings interfere with working conditions. A truck-carried camera, towing its own light supply, is able to provide a successful telecast.

Prospects for the future, generally speaking, are excellent. More stations will begin operations between more cities. Once the obstacles of replacing spare parts and of training maintenance and technical help are overcome, Brazilian TV will flourish.

Conclusion

The Chairman wishes to express his thanks to the Committee members and all others who contributed to this report. If a report of your accomplishments was omitted, it was because the Committee did not know of them. The Committee realizes that many reports were lengthy and that there is some duplication from section to section.

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Transmission of Color Over Nationwide Television Networks

By FRANK A. COWAN

The nationwide television networks utilize coaxial and radio-relay systems for interconnecting the radio stations. The Bell System provides over 75,000 miles of such intercity channels. Coaxial and radio-relay systems are described briefly and questions of network operation are discussed. Color television adds requirements to the design of the television channel which are explained, and the nationwide layout for black-and-white and for color programs is discussed.

THE NATIONWIDE television networks are furnished by means of television channels over Bell System routes now carrying over 75,000 miles of intercity channels. In addition there are hundreds of miles of local channels within the cities where the networks terminate.

Types of Facility

There are two types of plant suitable for transmitting the broad band of frequencies required for television over long distances; namely, radio relay and coaxial cable. Radio relay provides about 80% of the total channel mileage today, while coaxial cable provides about 20%. The type of facility chosen for use in any given instance is that which will most economically provide present and future service requirements.

The great bulk of our radio-relay routes makes use of a radio-relay system manufactured by the Western Electric Company, designated TD-2. This is a microwave system operating in the frequency range of 3700 to 4200 mc. Figure 1 is a block diagram showing the general arrangement of equipment at relay stations along a TD-2 route.

It may be seen that the transmitting station, shown schematically on the left, is arranged to handle six separate channels in one direction of transmission. The opposite direction of transmission is handled in the same manner as shown by this one-way schematic. These channels, after passing through branching filters, are combined in the transmitting waveguide and from there they are carried to the antenna which will accommodate frequencies in the bandwidth of 3700 to 4200 mc.

At the intermediate auxiliary station, the signals are received on an antenna similar to that at the transmitting point and passed down through waveguides to the radio equipment where the channels are separated by branching filters. Just beyond the filters the radio frequencies are changed to the intermediate frequency of 70 mc. The receiving converter is followed immediately by a low-noise preamplifier. The signals at the intermediate frequency are then amplified before entering the transmitting modulator. The beat-frequency oscillator for this modulator is so chosen as to shift the radio frequency upward or downward by 40 mc with respect to the receiving radio frequencies. After passing through a 3-stage radio-frequency amplifier, the various channels are combined in the output waveguide by means of the branching filters in the same manner as at the transmitting station.

Figure 2 illustrates the general appearance of a typical TD-2 radio-relay station. These stations are required at intervals of approximately 25 to 30 miles along radio-relay routes.

A TD-2 system is capable of providing six radio channels in each direction. Each of these radio channels can carry hundreds of telephone circuits (in one direction) or one television program. One radio channel in each direction is usually assigned as a protection channel

Presented on October 6, 1955, at the Society's Convention at Lake Placid, N. Y., by Frank A. Cowan, Long Lines Dept., American Telephone & Telegraph Co., 32 Ave. of the Americas, New York 13.
(This paper received in final form, March 29, 1957.)

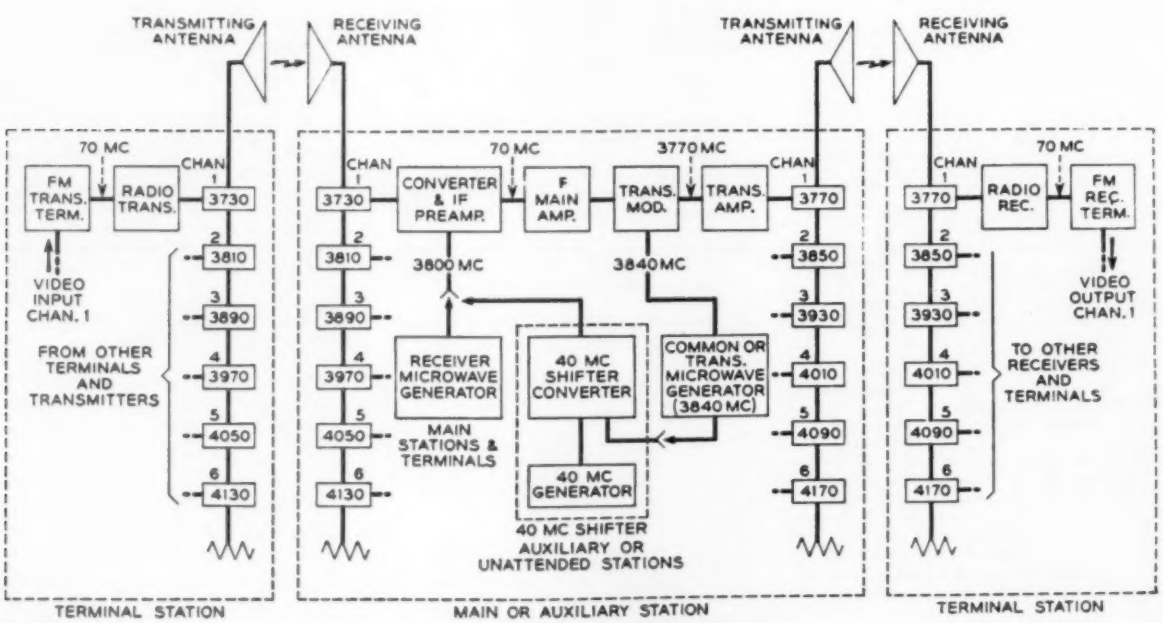

Fig. 1. Radio-relay block diagram.

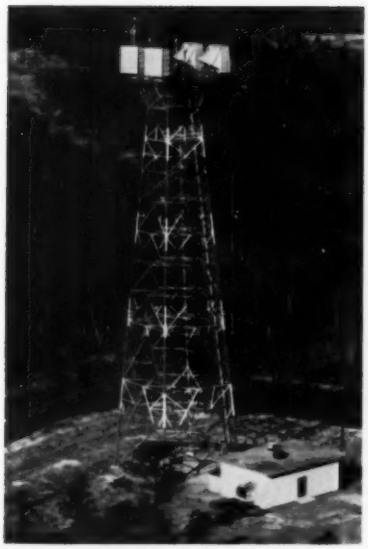

Fig. 2. Radio-relay station.

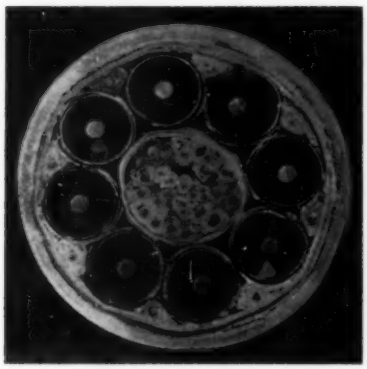

Fig. 3. Eight-tube coaxial cable.

in case of interruptions. Automatic switching equipment is provided at intervals averaging about 150 miles, to switch in the protection channel in case of failure of any one of the working channels.

Figure 3 is a photograph of a cross section of a typical coaxial cable containing eight coaxials. Each coaxial consists of a copper tube at the center of which is suspended a copper wire. Generally, eight coaxials are contained in a single cable sheath, four transmitting in each direction. The center of the cable and the interstices between the coaxials contain paper-insulated copper conductors which are used for alarm, control and order wire circuits.

Two types of equipment are used on these coaxial cables today. The older system, known as L-1, requires amplifiers at intervals of eight miles, and transmits a frequency band from 60 to 3100 kc on the cable. This system is capable of handling 720 one-way telephone channels or one television circuit on each coaxial. The television terminal equipment, utilizing a carrier frequency of 311 kc, modulates the video signal so that it falls in the frequency range of the coaxial line. Because of the limited bandwidth mentioned above, the actual video signal is restricted to an upper frequency of about 2800 kc.

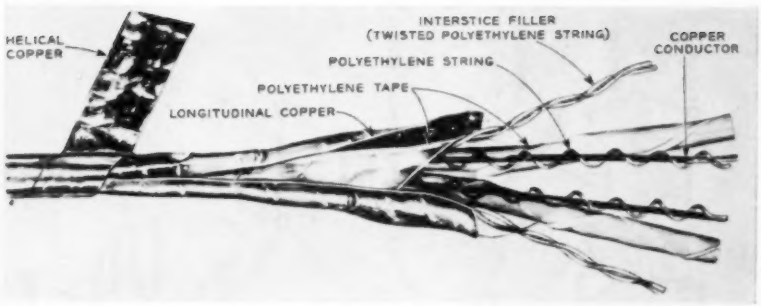

Fig. 4. Video pair.

The newer L-3 system requires amplifiers at intervals of four miles and transmits line frequencies from 300 to 8300 kc. Each coaxial can provide 1860 one-way telephone channels, or alternatively, 660 one-way telephone channels and one television channel. The television terminal equipment, in this case, uses a carrier frequency of 4139 kc modulating the video signal into the region from about 4000 to 8300 kc on the coaxial, while the telephone channels use the lower portion of the available space.

Between telephone offices where the intercity networks terminate and the customers' premises within the same city, so-called "local loops" are provided. In some cases these are provided by radio-relay hops, but in general it is more economical and also more practical, in view of congestion of the radio-frequency spectrum, to use special pairs in underground cables. These "video" pairs consist of heavy-gauge copper wires contained in a copper shield. Figure 4 illustrates such a pair, showing how polyethylene strings and tapes are used to keep the structure firm with a minimum of solid dielectric material and a maximum of air dielectric.

Used with these pairs, the video systems currently being provided have improved amplifiers and equalizing equipment, resulting in a much-improved low-frequency characteristic and a wider bandwidth than the older systems. This is accomplished by arranging the equipment to give a better impedance match to the video cable pairs and by improved matching of equalization shapes. As a result, these systems provide essentially flat transmission from 30 cycles to about 4.5 mc. The newer systems are called A2A, while the older ones are known as A2.

Transmission Quality and Reliability

The objectives to be met in providing television service are, of course, satisfactory transmission quality and reliability. Attainment of both these objectives becomes a problem because of the size, complexity and need for flexibility of the networks.

As an illustration, Fig. 5 shows a typical arrangement of the network furnished to one of the major broadcasting companies. This network contains a total of 18,500 miles of channels, 13,000 on radio relay routes and 5500 on coaxial cable.

Programs fed over this network originate principally in New York or Hollywood. When programs originate in New York, there are 227 repeater stations in tandem between there and the most distant broadcasting station, which is El Paso, Texas, and the average number of repeater sections to all stations served is 84. When Hollywood is the originating point, there are 250 repeater stations between there and Miami, and the average number of repeater sections to all stations served is 130.

With such large numbers of amplifiers in tandem, it is evident that distortions permitted in individual sections must be kept very small if overall transmission quality is to be kept within satisfactory bounds. In the matter of reliability, too, each individual section must provide a very high standard of reliability since any outage may result in interruption to those sections which follow.

The transmission problem is further complicated by requirements of the broadcasters for switches at frequent intervals. The network of Fig. 5 illustrates only one service period. The following program may originate at a different city and may be ordered fed to different broadcasting stations. To make such switching possible, the characteristics of the various sections of network must be sufficiently uniform to permit them to be used in various combinations and still deliver satisfactory signals at all receiving points.

Color

The NTSC color television signal contains a full monochrome signal, known as the luminance component of the color signal, and in addition, contains a chrominance component which carries

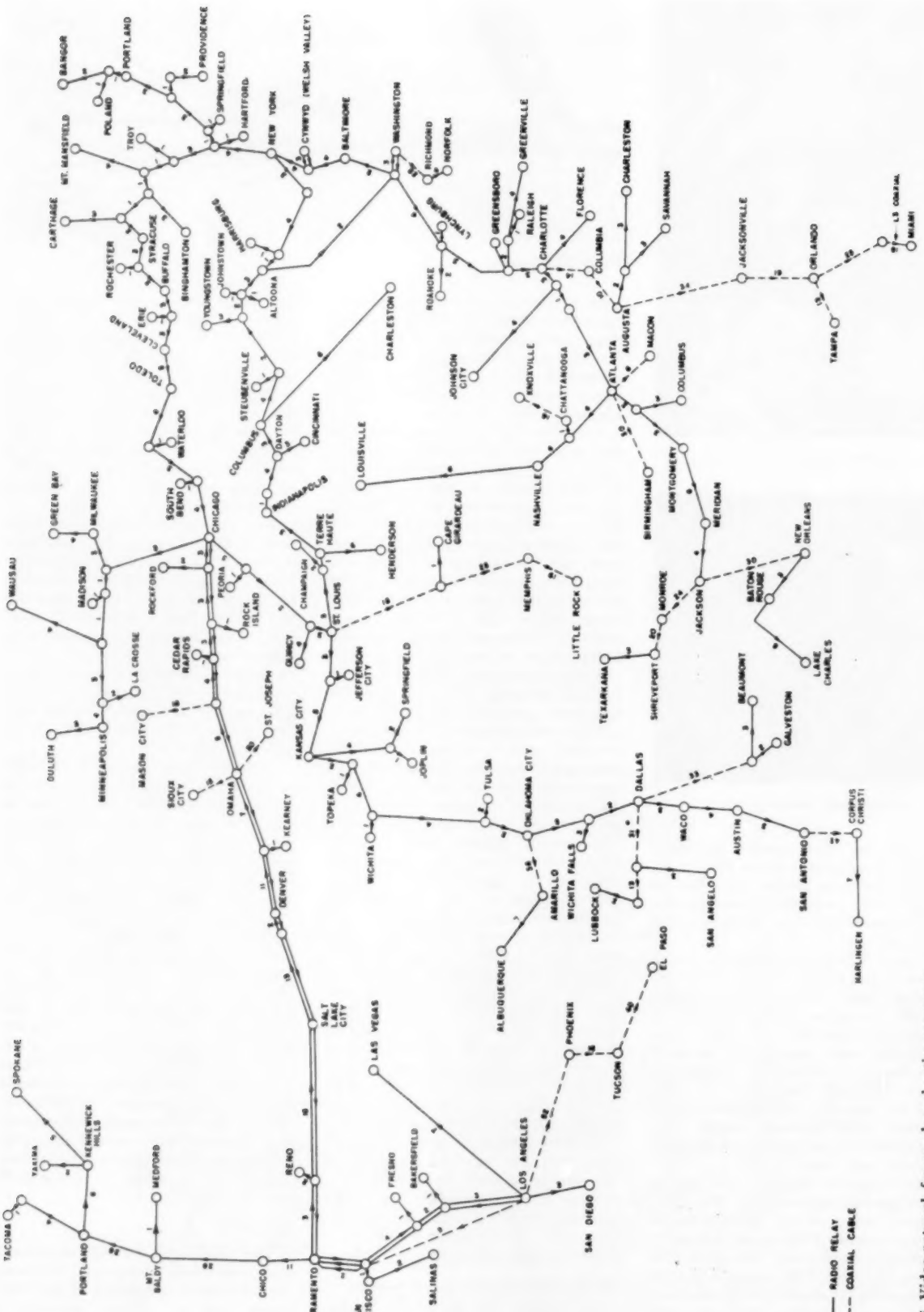

Fig. 5. Video network for one broadcasting company.

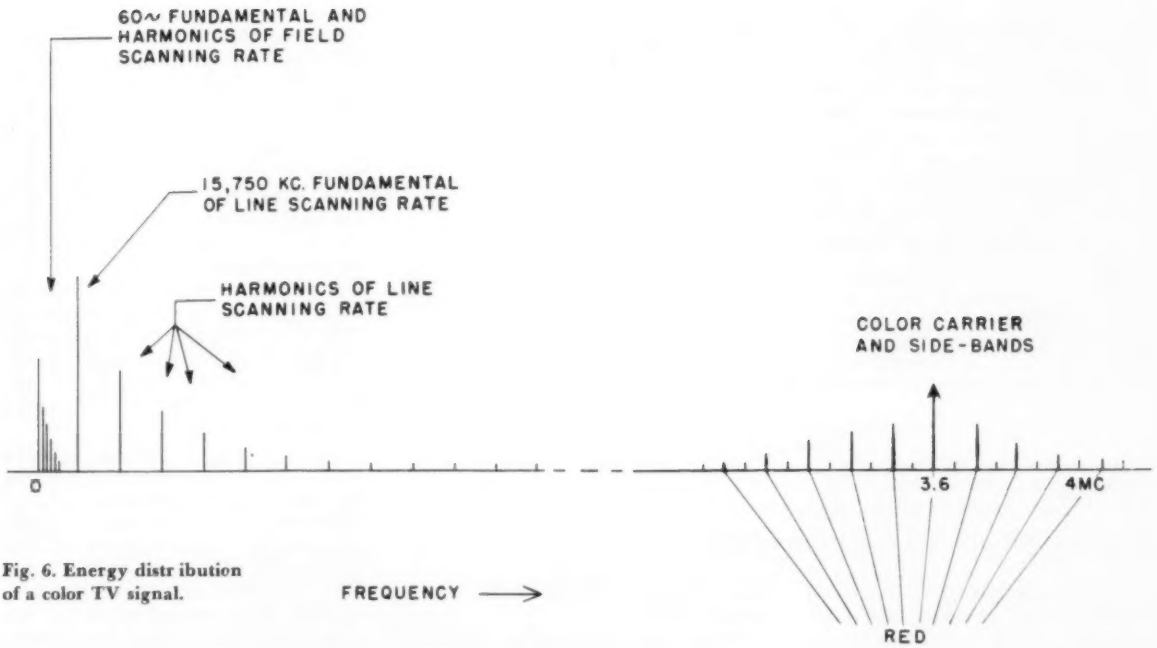

Fig. 6. Energy distr ibution of a color TV signal.

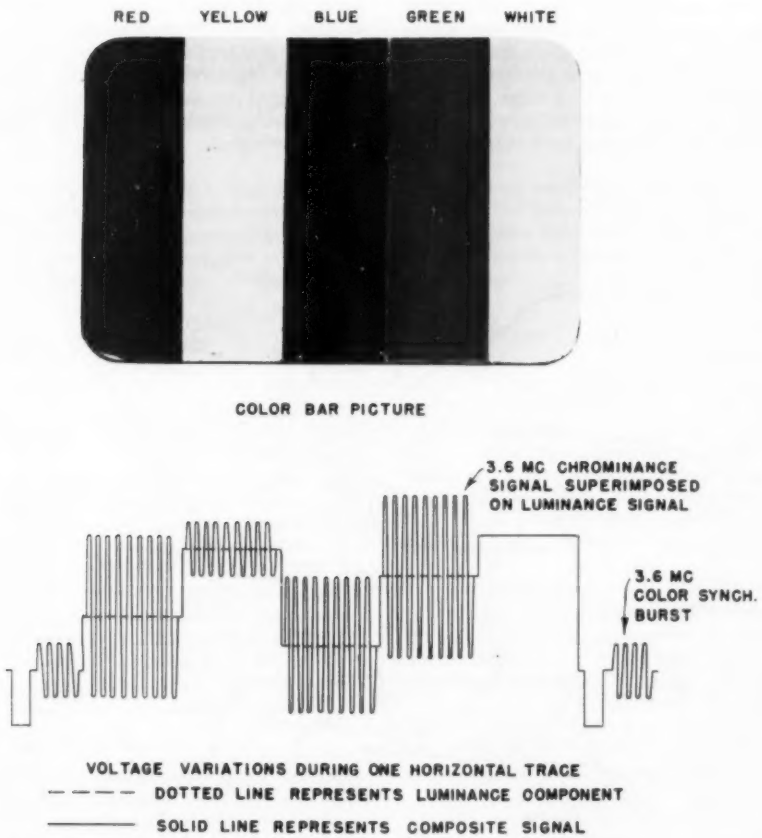

Fig. 7. Illustrative color TV signal.

color information. The transmisssion requirements which the networks must meet are more exacting for color than for monochrome.

Figure 6 illustrates the energy spectrum of a television signal. The black lines indicate the energy in the luminance portion of the signal. We see bundles of energy, at frequencies which are multiples of the line-scanning frequency, which spread across the entire frequency band up to about 4 mc.

The red lines indicate the energy in the chrominance component which consists of the so-called "color subcarrier" at about 3.6 mc, which is modulated in both amplitude and phase, in accordance with the saturation and hue, respectively, of a particular color.

Now, in transmitting monochrome signals, it is necessary that amplitude and delay deviations in the transmitting medium be held within very close limits at the low-frequency end of the video-frequency band. It is permissible, and sometimes even desirable, to roll off the amplitude characteristics somewhat at the high-frequency end. With the added color component, this is no longer true; the gain and delay of the transmission medium must now be nearly as rigidly controlled at the high end as at the low.

In addition to tightening the normal black-and-white transmission requirements, color has also made it necessary to consider some transmission characteristics which do not ordinarily affect monochrome transmission. Principal among these are "differential gain" and "differential phase," that is, change in gain or phase at the color transmission frequencies as the level of luminance signal changes.

Figure 7 illustrates how this may come about. Here we see a picture consisting of vertical bars of various colors, and below it a representation of the voltage over each horizontal scan. The luminance component of the signal is represented by the dotted line. The color information is contained in the modulated 3.6-mc carrier superimposed on the luminance signal. The color information is demodulated in the receiver by means

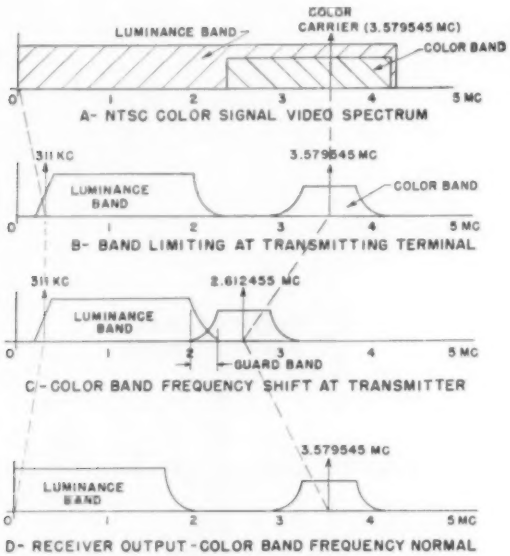

Fig. 8. Spectrum compression for L1 coaxial system transmission of NTSC color signals.

of a synchronous detector whose phase is controlled by the reference color burst transmitted during the back-porch interval. If there is any appreciable difference in phase shift at 3.6 mc for different luminance levels, colors will not be reproduced in proper hue. People's faces, for example, may be changed to sunburn-red or seasick-green. The effects of differential gain are not so marked, but will show up as washed-out or too-intense colors.

When color transmission was first tried, excessive amounts of differential gain and differential phase were measured on most radio-relay routes. This was found to be due to the fact that FM transmission is used on these routes, so that the radio carrier shifts in frequency when the luminance level changes. The degree of gain-frequency and delay-frequency equalization of the radio channels was not good enough to meet the very strict requirements of the color signal. This condition has been remedied by improved equalization of the radio systems, inserted at intermediate frequencies, and by pre-emphasis of the video signals to reduce the amount of low-frequency energy, thus restricting the frequency band over which the FM signal is required to swing.

Another question which arose with the color signal was how to get it through Type L1 coaxial-cable facilities, since the top video frequency which such channels will pass is about 2.8 mc. The 3.6-mc color subcarrier cannot be transmitted over these channels.

Figure 8 indicates how this problem was solved. At the transmitting terminal the luminance and chrominance components are separated by means of filters. The luminance signal is picked out by a low-pass filter cutting off at about 2 mc. The chrominance signal is selected by a bandpass filter centered at 3.6 mc. For transmission over the coaxial, the chrominance signal is shifted to a band centered at about 2.6 mc. At the receiving terminal it is shifted back to normal frequency.

No such expedients are necessary with the newer Type L3 coaxial channels, since these channels will pass the full-color video signal.

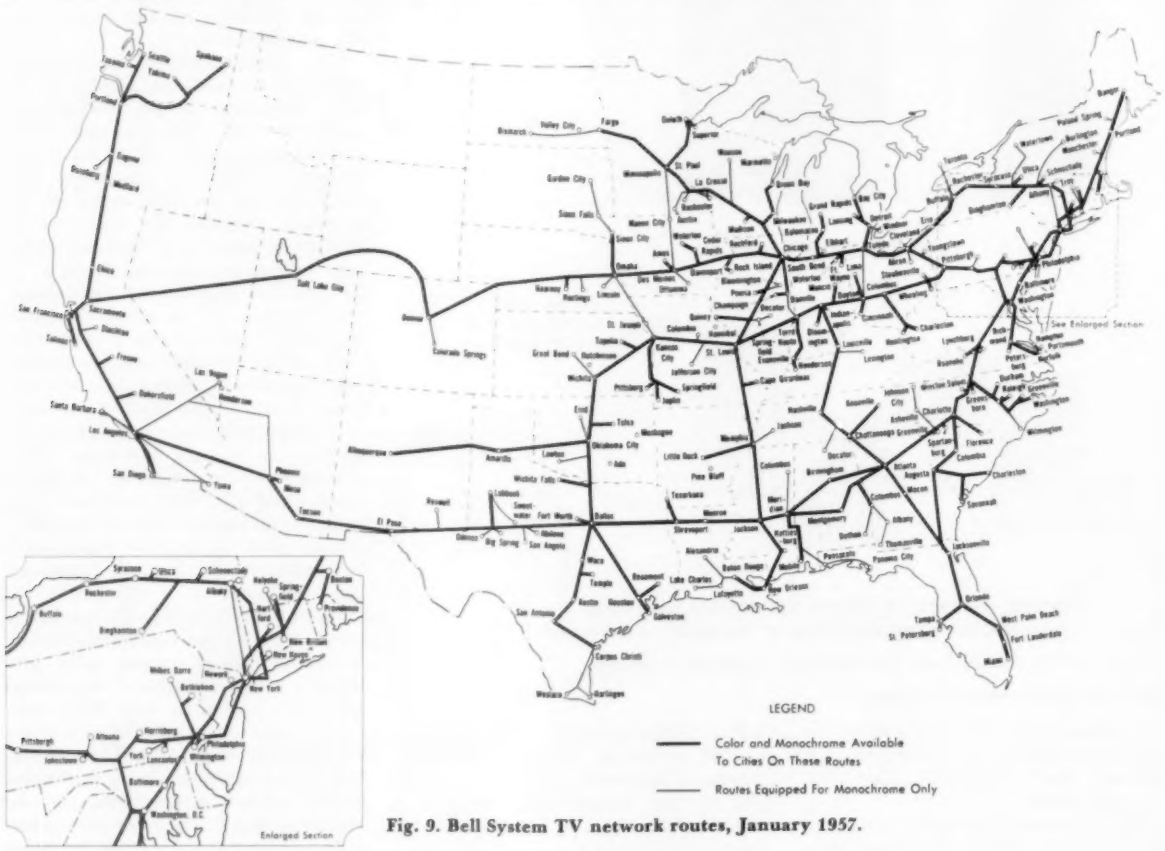
See Enlarged Section
LEGEND
Color and Monochrome Available To Cities On These Routes
Routes Equipped For Monochrome Only
Enlarged Section

Fig. 9. Bell System TV network routes, January 1957.

Progress of Color

The Bell System was not taken by surprise in December 1953, when the FCC approved the NTSC color system. Experimental work in transmitting color signals had been carried on for several years before that, first with NBC and RCA, and later with NTSC. As a result, the requirements of color were pretty well known by the time the NTSC system became official, and plans had been laid for providing the necessary network changes to meet customers' requirements for color transmission. (It may be mentioned here, parenthetically, that similar experiments in cooperation with CBS had been carried out a few years previously to determine the requirements of the sequential color system.)

Some of the high points which may be mentioned in connection with preparations for transmission of NTSC color signals are:

1. Demonstration of the NTSC system to the FCC on November 6, 1953. For the purposes of this demonstration, channels were provided from New York to Washington and back again on both L1 coaxial and radio-relay facilities. Pictures were successively viewed using each type of facility and also with direct local transmission. The quality of transmission over both types of facilities was adjudged to be fully satisfactory.

2. A transcontinental closed-circuit television transmission was provided on November 18, 1953. A New York program was transmitted to Hollywood.

3. On January 1, 1954, the first commercial color broadcast was furnished when the *Tournament of Roses* parade in Pasadena was transmitted to 18 television broadcasting stations across the nation.

Since the inauguration of color, progress in equipping channels for transmission of color is shown by Fig. 9. The heavy lines indicate network sections where color channels are now available. We can say we have satisfied the desires of our customers in providing these facilities.

While color transmissions are quite good, there are a number of improvements currently being worked on to improve the present systems. Among these are further improvements in the TD-2 radio-relay system to provide flatter and more stable gain and delay characteristics; improvements in equalization of Type L1 coaxial lines; improvements in equalization and stability of the video amplifiers used on local loop facilities; and replacement of switching arrangements provided at telephone company television operating centers to obtain more flexibility in switching color signals than is posssible with the existing switches.

Conclusion

While perfection has not been reached, it is believed that the transmission problems of color signals are well in hand. Transmissions today are generally quite satisfactory and will be further improved as time goes on.

New High Intensity Rotating Positive Carbons for Motion-Picture Projection

By R. B. DULL, J. G. KEMP, Jr., and E. A. NEEL, Jr.

New 10mm and 11mm High Intensity Projector carbons have been developed for rotating positive-carbon-type motion-picture projection lamps. These carbons, designed for 95–110 and 110–120 amp, respectively, give substantial increases in light and efficiency, and operate with greater stability than former carbons of the same size and type. Performance data are presented.

THE UNIVERSAL adoption of wide screens by large indoor theaters and the trend toward larger screens in outdoor theaters have created a need for more light. To meet this demand, two new carbons for reflector lamps of the rotating positive-carbon type have been developed, one a 10mm × 20-in. and the other an 11mm × 20-in. High Intensity Projector Positive carbon. The performance of 10mm and 11mm carbons in use during the past few years has been described by Holloway, Bushong and Lozier.[1] This paper will describe the performance of the improved 10mm and 11mm High Intensity Projector Carbons.

New 10mm Carbon

In an effort to obtain the maximum possible light from the old 10mm High Intensity Projector Carbon it was often burned at 105 amp, or 5 amp above its recommended maximum current. The new carbon has a maximum recommended current of 110 amp, i.e., 10 amp higher than that of the carbon it has replaced. At 105 and 110 amp, in a projection lamp adjusted to give maximum light at the center of the screen, the new and improved carbon produces approximately 8% and 12% more light, respectively, than the old 10mm carbon at 100 amp.

Although the recommended maximum current for the improved 10mm carbon is 10 amp higher, its recommended minimum current of 95 amp remains the same as that of the old 10mm carbon. At 95 amp in a lamp adjusted for maximum light at the center of the screen, it produces about 3% more light than the old 10mm carbon at the same current.

Relative maximum screen light as a function of arc current is shown in Fig. 1, where the screen light from the old 10mm carbon at 100 amp is used as a basis for the comparison.

The results are approximately the same when the projection lamp is adjusted to give 80% side-to-center light distribution on the screen. At 105 and 110 amp, the new 10mm carbon gives 5% and 10% more light, respectively, than the old carbon at 100 amp.

The efficiency of the new 10mm carbon is considerably greater than that of the old carbon as illustrated in Fig. 2, where relative maximum screen light is shown as a function of relative carbon consumption with light and consumption of the old carbon at 100 amp taken as the base. At any current in the 95- to 100-amp range, the new carbon burns approximately 15% slower than the old one, at a corresponding current, while producing slightly more light regardless of whether the projection lamp is adjusted for maximum screen light or for 80% side-to-center light distribution. At a given light level the increase in efficiency is even greater than at a given current. In the 95- to 100-amp range, at corresponding light levels, the new carbon burns 20% to 25% slower.

In addition to the advantages described above, the crater of the improved carbon is deeper, larger in diameter and remains straighter than that of the older 10mm High Intensity Projector Carbons. These features contribute to a steadier and more uniform screen light.

New 11mm Carbon

The improved 11mm High Intensity Projector Carbon is particularly suited for drive-in theaters, especially those having very large screens. The old 11mm carbon had a recommended current

Presented on October 10, 1956, at the Society's Convention at Los Angeles, by R. B. Dull (who read the paper), J. G. Kemp, Jr., and E. A. Neel, Jr., National Carbon Co., A Division of Union Carbide Corp., Fostoria, Ohio.
(This paper was received on March 24, 1957.)

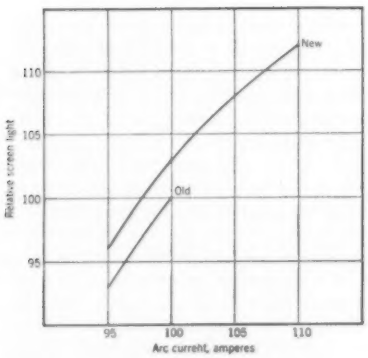

Fig. 1. 10mm High Intensity Projector Carbon — relative screen light vs. arc current, at maximum screen light.

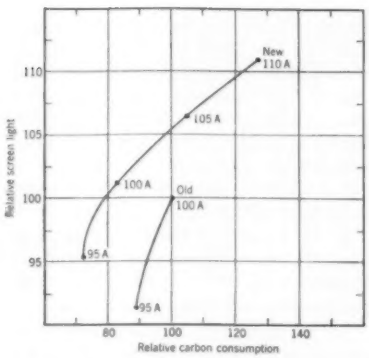

Fig. 2. 10mm High Intensity Projector Carbon — relative screen light vs. relative carbon consumption.

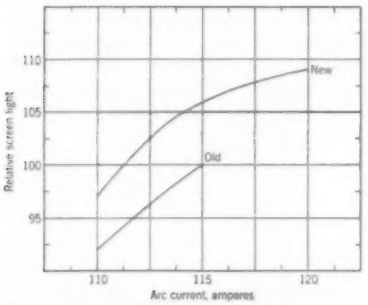

Fig. 3. 11mm High Intensity Projector Carbon—relative screen light vs. arc current, at maximum screen light.

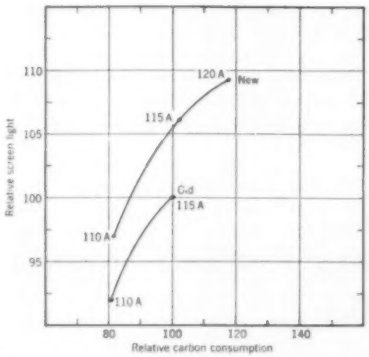

Fig. 4. 11mm High Intensity Projector Carbon — relative screen light vs. relative carbon consumption.

range of 110 to 115 amp, but like the old 10mm High Intensity Projector Carbon, it was often burned above its recommended maximum current in order to obtain the maximum possible light, in spite of the fact that some unsteadiness was encountered. The improved 11mm carbon has a recommended current range of 110 to 120 amp, or 5 amp higher than the carbon it has replaced.

A comparison of relative light for the old and new carbons, as a function of current, when the projection lamp is adjusted to produce maximum light at the center of the screen, is shown in Fig. 3. The light output of the old 11mm carbon at 115 amp has been selected as the basis for the comparison. At 115 and 120 amp, the improved carbon produces approximately 5% and 10% more light, respectively, than the old 11mm carbon at 115 amp. This also holds true when the projection lamp is adjusted for 80% side-to-center light distribution. Figure 3 shows that identical light levels can be obtained by reducing the current for the improved carbon by 3 to 4 amp.

As in the case of the improved 10mm carbon, the new 11mm carbon is more efficient than the old one. At comparable light levels the new carbon burns 10% to 15% slower than the old one, as illustrated in Fig. 4.

A larger and deeper crater combined with an ability to hold a straighter crater are features of the improved 11mm carbon contributing to a more uniform and steadier light on the screen.

Table I. Screen Illumination With New 10mm and 11mm High Intensity Projector Carbons in $f/1.7$ Motion-Picture Projection System — 0.715-in. × 0.839-in. CinemaScope Aperture for Optical Sound.

Carbon	Amps	Volts	80% Distribution Screen lumens	80% Distribution % Dist.	Maximum light Screen lumens	Maximum light % Dist.	Approx. carbon consumption rate, in./hr
10MM × 20-in. new H. I. Projector	95	51–57	22,200	80	27,100	60	15.0
10MM × 20-in. new H. I. Projector	100	54–59	23,800	80	29,100	60	16.5
10MM × 20-in. new H. I. Projector	105	56–61	25,000	80	30,500	60	21.5
10MM × 20-in. new H. I. Projector	110	59–65	25,900	80	31,600	60	24.5
11MM × 20-in. new H. I. Projector	110	57–62	25,200	80	31,200	60	12.5
11MM × 20-in. new H. I. Projector	115	58–64	26,600	80	33,200	60	16.0
11MM × 20-in. new H. I. Projector	120	59–68	28,000	80	34,700	60	20.5

Summary of Performance

The development of new 10mm and 11mm High Intensity Projector Carbons has contributed to the advancement of wide-screen motion-picture projection by (1) making more light available through the extension of the upper limits of their current ranges, and (2) producing a steadier and more uniform screen light through a deeper and wider crater, and a crater which has less tendency to become crooked during the projection of a film. The latter feature means that less attention need be given to the carbons to insure optimum projection conditions.

Screen Illumination and Carbon-Consumption Rates

When Holloway, Bushong and Lozier[1] published their paper in 1953, the 16½-in. diameter, $f/1.9$ lamp reflector, $f/2.0$ and $f/1.9$ projection lenses, and standard 0.600-in. × 0.825-in. aperture were widely used. Since 1953, 18-in. diameter, $f/1.7$ reflectors and $f/1.7$ projection lenses have become available, and the use of larger apertures has become almost universal. Table I gives the screen light in lumens, distribution of light on the screen, and carbon consumption at various operating conditions, for the new 10mm and 11mm carbons, when used in a typical projection lamp having an $f/1.7$ optical system, and when the light is projected through a CinemaScope aperture for optical sound (0.715 in. × 0.839 in.), onto the motion-picture screen by means of a 4.0-in. E.F. $f/1.7$ projection lens. The screen lumen figures are for systems with no shutter, film or filters of any kind. Since arc voltage is a function of lamp design, as well as a number of other factors, a range of arc voltages has been given for each current, rather than a single voltage.

Although the improved 10mm and 11mm High Intensity Projector Carbons are capable of producing as much light as the old carbons at a lower current and consumption rate, it is recommended that they be used at their maximum rated current in order to take full advantage of the increase in light which is so badly needed on the large screens.

Reference

1. F. P. Holloway, R. M. Bushong and W. W. Lozier, "Recent developments in carbons for motion-picture projection," *Jour. SMPTE, 61:* 223–240, Aug. 1953.

Tri-Partition of a Sound Stage

By D. J. BLOOMBERG
and M. RETTINGER

The partitioning of an existing sound stage on the Republic Studios lot is described as converted into three equally sized television stages. Various means are discussed for increasing the sound insulation between adjacent stages so that it is possible to construct sets in any one stage while sound recording takes place in adjacent stages.

THE TREND in a number of motion-picture studios has been to provide added facilities for the production of television features. In some instances this has called for dividing one large sound stage into two or more smaller studios. The requirement for such multiple buildings usually is that it be possible to carry on set construction in any one stage while sound recording takes place in an adjoining stage. The construction of new multiple sound stages under a common roof has been described by Bloomberg, Pond and Rettinger.[1] It is the purpose of the following to discuss the partition of an existing sound stage, on the Republic Studio lot, into three equally large television stages.

The original stage was 120 ft wide, 200 ft long and 57 ft high. The tri-partition was to be effected in such a manner as to provide stages 120 ft long, 66 ft wide and 57 ft high. The partitions were to be of the double-wall type, each wall resting on a separate foundation, for increased sound insulation. The floors in the stages were to consist of $\frac{13}{16}$-in. T&G kiln-dry, vertical-grain pine applied on 2-in. thick wood blocks; the blocks in turn were to be placed on a 6-in. concrete slab.

The manner in which solid-borne sound is transmitted (and suppressed) is noticeably different from that of air-borne sound. Solid-borne sound in stage floors consists generally of impact noise, such as hammering, the dropping or dragging of heavy objects across the floors, etc. Compared to the powers involved in the production of air-borne sounds, vibratory powers are enormous. The acoustic power generated by a person speaking in a conversational tone of voice rarely is much greater than a microwatt; whereas the vibratory power generated by hammering, may exceed watts.

Vibrations are communicated through continuous solids with very little attenuation. Building materials which readily transmit vibrations are concrete and steel. Also, in the case of material layers, such as concrete slabs, we do not deal with spherical waves of propagation, whose energy (in the absence of dissipation) decreases inversely with the square of the distance; but deal instead with cylindrical waves, whose energy falls off uniformly with the distance. Therefore, as in the case of shallow bodies of water, the signal range is very large. Hence, solid-borne sound should be suppressed as much as possible at its source. A good "dead" material for a sound-stage floor is vertical-grain wood blocks. The basic theory of such a flooring is that the log set on end is used as a chopping block. Such blocks are readily able to absorb heavy hammer blows, chiefly by converting the vibratory energy into heat within the block.

The blocks of wood, of course, must be applied against a solid base, so as to maintain a flat surface. Therefore, they were placed on a 6-in. concrete slab, and bonded to it with asphalt. Specifications for laying this type of floor are described in the Motion Picture Research Council Bulletin #58.456-A. One important factor to be carefully controlled in the use of this type of flooring is the maintenance of a level subfloor of concrete for the wood blocks. In this installation, the specifications called for a maximum deviation of $\frac{1}{16}$ in. in a 10-ft span of concrete.

The subsoil beneath the concrete was compacted to 90% compression. A 6-in. concrete slab was laid on this ground with $\frac{3}{8}$-in. steel bars on 12-in. centers. This furnished a strong subfloor capable of carrying concentrated loads in excess of 7500 lb/sq ft. After laying and impregnating the wood blocks in asphalt, they were sanded to maintain the same level tolerances as were used for the concrete slab.

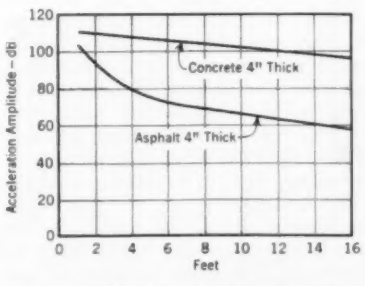

Fig. 1. Reduction of the acceleration amplitude in concrete and asphalt slabs.

Another condition to watch is the tongue-and-groove tolerances of the vertical-grain, pine finish-floor. This should be No. 1 grade, kiln dry, with tight-fitting tongues and grooves. The finish-floor should be nailed with No. 8 penny screw nails, and the butt joints should be double surfaced nailed. The finish-nailing is done diagonally, through the tongue with the nails spaced 12 in. apart. Where finish-floor is split or tongues or grooves are broken, they should be replaced or double surfaced nailed. These steps are extremely important in securing a quiet floor that does not "pop" when a camera dolly is rolled over it. The 6-in. concrete slab is not continuous throughout the floor, but has a 1-in. wide isolation joint 5 ft from each partition. Also, the slabs do not abut on the foundations of the partition but are separated from them by a 2-in. thick asphalt-impregnated glass fiberboard, as are the concrete slabs abutting against the original wall foundations. These isolaters extend from the subsoil to the top and through the finish wood floor. The separator joint 5 ft from each partition serves as a point beyond which set construction is not allowed. This provides additional isolation from heavy impact vibrations occurring beyond the joints.

Figure 1 shows the reduction of the acceleration amplitude in concrete and asphalt slabs. The source of the vibrational energy was a hammer blow. Each slab was 4 in. thick. The reduction of vibrational energy with distance is considerably less in concrete than in asphalt.

To insure sound isolation between stages, the existing side walls and sidewall concrete footings were cut and filled with asphalt-impregnated glass wool or a nontransmitting mastic. This division was made from the bottom of the existing footings up to the lower intersection of the roof. The roof was not cut as it was believed that it represented a substantial mass of inert or dead material and would not transmit an appreciable amount of impact vibrations most of which occurred at a lower level. Final results supported this conclusion.

A schematic of the double-wall partition is shown in Fig. 2. The framing structure of each wall had been prefabricated and was erected on the stage with the aid of large cranes. After the framework was in place, the walls were plastered with two coats of $\frac{1}{2}$-in. thick cement plaster. The cement plaster was sprayed on, using an air compressor with special hose and nozzle. The cement plaster was not finish trowelled. This method of application proved a time and labor saver, and

Presented on May 3, 1957, at the Society's Convention at Washington, D.C., by J. V. Leahy for the authors, D. J. Bloomberg, Republic Productions, Inc., 4024 Radford Ave., North Hollywood, Calif., and M. Rettinger, Engineering Dept., Commercial Electronics Products, Radio Corp. of America, 1560 N. Vine St., Hollywood 28.
(This paper was received on March 4, 1957.)

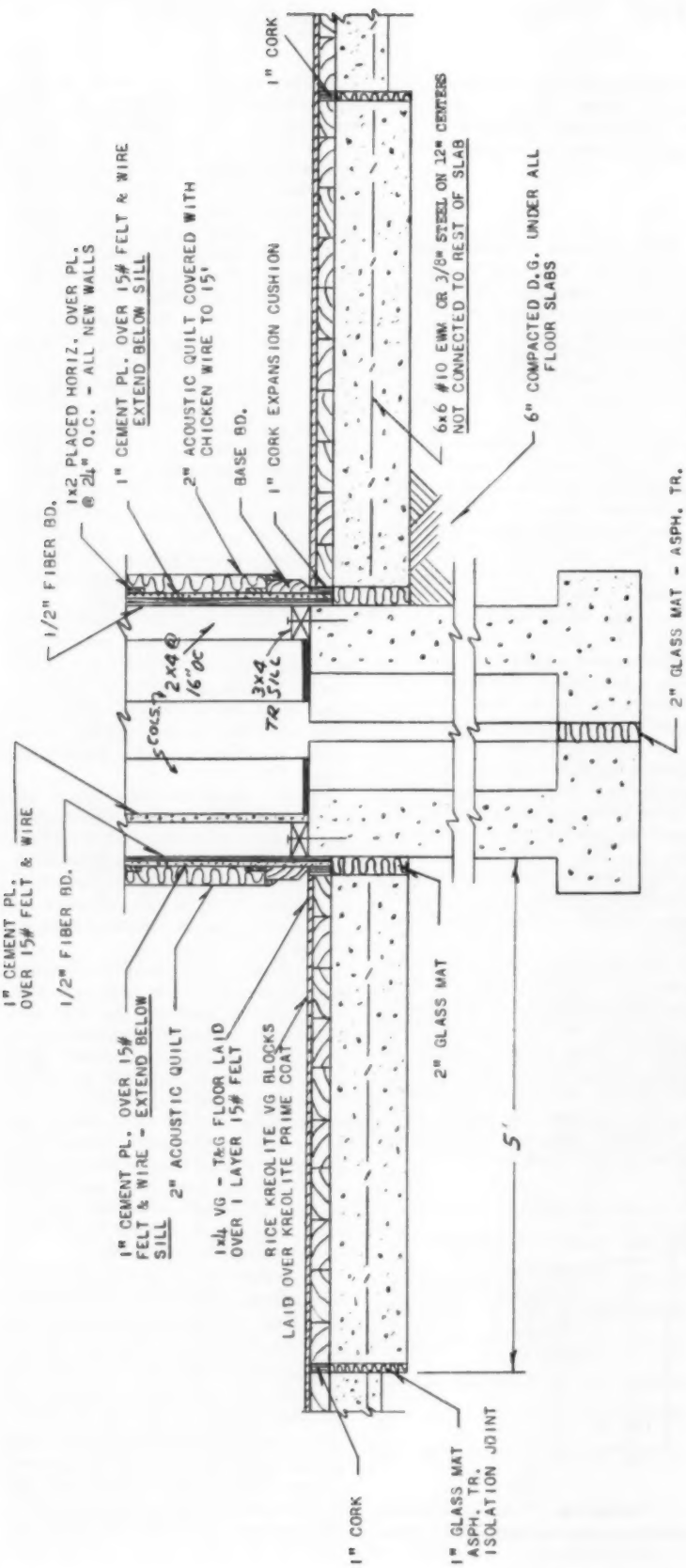
1" CORK
1x2 PLACED HORIZ. OVER PL. @ 24" O.C. - ALL NEW WALLS
1" CEMENT PL. OVER 15# FELT & WIRE EXTEND BELOW SILL
2" ACOUSTIC QUILT COVERED WITH CHICKEN WIRE TO 15'
BASE BD.
1" CORK EXPANSION CUSHION
6x6 #10 EWW OR 3/8" STEEL ON 12" CENTERS NOT CONNECTED TO REST OF SLAB
6" COMPACTED D.G. UNDER ALL FLOOR SLABS
1/2" FIBER BD.
2x4 @ 16" OC
3x4 TO SILL
COVE
2" GLASS MAT - ASPH. TR.
1" CEMENT PL. OVER 15# FELT & WIRE
1/2" FIBER BD.
1" CEMENT PL. OVER 15# FELT & WIRE - EXTEND BELOW SILL
2" ACOUSTIC QUILT
1x4 VG - TAG FLOOR LAID OVER 1 LAYER 15# FELT
RICE KREOLITE VG BLOCKS LAID OVER KREOLITE PRIME COAT
2" GLASS MAT
5'
1" CORK
1" GLASS MAT ASPH. TR. ISOLATION JOINT

Fig. 2. Schematic of double-wall design for 70-db transmission loss; floor design; and mechanical vibration isolation.

provided a very dense cement plaster mass. The rock-wool treatment was applied to the walls over wood stripping.

Wherever the grid timbers were to be supported by the partition, they were isolated from it by an elastic support as shown on Fig. 3. This was done to avoid the transmission of impact noises generated on the grids caused by attaching or nailing set supports to them. It should be noted here that extreme care was taken to avoid all continuous solid contacts between stages, no matter what these solids were — ties, pipes, ducts, etc.

From all types of experience and observation gained over a number of years by these writers, it was learned that wherever undesirable solid-borne sounds were transmitted between adjoining rooms, it was not always lack of separate foundations on the part of the double-wall partition, or flimsy wall construction, or "too solid" ground, etc., which was responsible for the shortcoming, but that it was often one or more solid connections between the two enclosures. These connections could be of various kinds and made of many different materials and they were by no means readily obvious. Ready offenders of this type are pipes of any sort — water pipes, gas pipes, "gutters" for carrying wires, sprinkler systems, etc. These pipes must be carefully insulated from any adjoining concrete or floor joists, usually by wrapping several $\frac{1}{2}$-in. layers of asphalt-impregnated ozite around the pipes before pouring concrete around them. If this is not done at the right time (during the early part of the alteration or construction work), subsequent corrective measures may become inordinately expensive.

Just how to evaluate the solid-borne, sound-transmitting properties of a wall or floor, is a difficult problem.[1-6] The literature quoted in the bibliography does not agree on any one method, and is even controversial at times. For instance, objections are offered to the use of so-called tapping machines employed for the generation of solid-borne sounds on the grounds that such a machine "gives an exaggerated effect, which is in character more forceful than the impact sound one meets in practice."[7]

While there are many kinds of impact noises occurring in a sound stage during set construction, the most frequently produced impact sound is a hammer blow. It was intended to duplicate this by dropping a brass weight through a predetermined distance. However, a hammer blow against the floor is not the most intense impact which generally occurs on the floor during set construction. The most intense "common" impacts occur during the erection of scaffolding, sets, "props" or the dropping of various pieces of equipment. Because it was desired to learn to what extent such intense impact sounds were carried from one stage to another, a "billionerger" was employed.

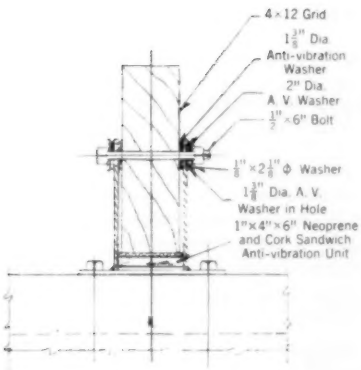
4×12 Grid
1 3/8" Dia. Anti-vibration Washer
2" Dia. A. V. Washer
1/2"×6" Bolt
1/8"×2 1/8" Φ Washer
1 3/8" Dia. A. V. Washer in Hole
1"×4"×6" Neoprene and Cork Sandwich Anti-vibration Unit

Fig. 3. Schematic of double-wall design showing grid timbers, supported by the partition, isolated by an elastic support.

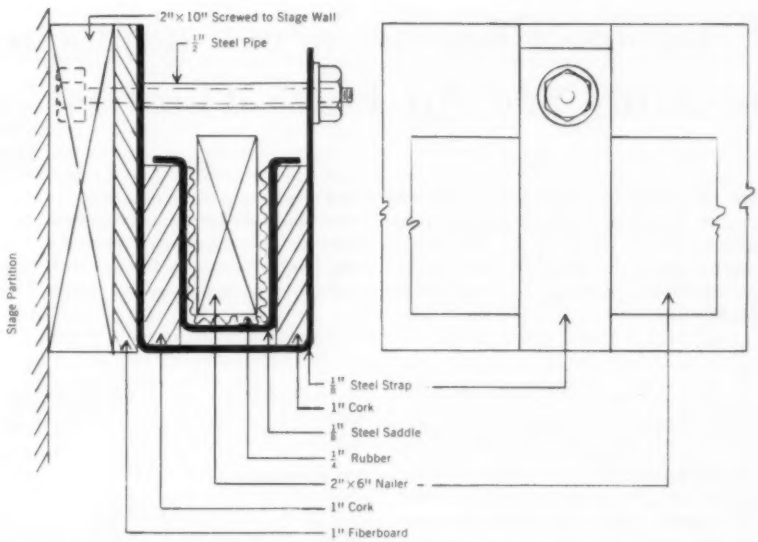

Fig. 4. Schematic showing type of wall construction used to eliminate transmission to adjoining stage of noise created by hammering against the wall of a partition.

This consisted of a 13-lb lead bar which was dropped from a height of 1.73 m (approximately 6 ft). Such an object develops, at the end of its travel, a kinetic energy equal to its potential energy before it has dropped. Thus:

$$E = MGH$$
$$= 13 \times 453.6 \times 980 \times 173$$
$$= 10^9 \text{ ergs}$$

where

M = mass of lead bar
= 13 lb
= 13 × 453.6 g
G = gravity constant
= 980 cm/sec²
H = height
= 173 cm

As far as transmission of impact noise through adjacent floors is concerned, no noise could be heard in the "receiving" stage when the lead weight was dropped, 6 ft from the nearest partition in the test stage. There was a faint, practically inaudible thud when the weight was dropped 1 ft from the nearest partition. This was probably due to the fact that, within 5 ft of the partition there is only one sound-isolation "break" in the concrete slab wood. As mentioned before, at 5 ft from the partition, there is another asphalt-impregnated glass fiberboard isolation joint in the concrete slab–wood flooring combination, so that any vibrations originating at distances longer than 5 ft from the partition have to bridge two "breaks," resulting in a consequently larger reduction of the transmitted impact amplitude.

Hammering against the wall of a partition carried into the adjoining stage, however, even though each wall of the double-wall partition rested on a separate foundation. This type of sound transmission is one of the most difficult to reduce or to eliminate because of the amount of energy involved. Intensive studies were made with various types of isolation units to devise a method that would reduce or eliminate this shortcoming.

It was finally decided to use a 2 × 6 nailing strip, 14 ft. high above the floor, which was resiliently mounted in isolation saddles spaced 5 ft apart, the nailing strip being attached to all stage walls (see Fig. 4). The isolation saddles consist of steel straps cemented to and resting on prestressed antivibration cork. The 2 × 6 nailer rests in these straps, and an outer steel strap supports this saddle, making contact with the saddle only through the cork. The steel strap was fastened to the structural members on the wall.

Instructions are given and rigidly enforced that all set bracing be attached to the isolated "nailer" strips only. In the adjoining stage, a reduction in sound level of 20 db was measured when a hammer blow was executed first against an isolated nailing strip, and then against the wall directly, the sound-level measurements being made with a General Radio Company noise-level meter set on the "flat" scale (c).

In tri-partitioning old sound stages, preplanning the acoustic treatment and isolation are a "must." None of the existing utility facilities should be overlooked. Good "acoustic" sense must be practiced to avoid costly and unnecessary construction. It is important that the continuous supervising of the acoustic isolation treatment be made the responsibility of a qualified acoustic engineer. One cannot stop at the completed stage plan, as the ordinary workman does not comprehend the importance of treating the various elements, and is apt to neglect or overlook an important point.

The tri-partitioning of the stages above described was completed in November 1956, and the stages have been in continuous operation since then. Set construction or shooting in any one stage does not interfere with similar work in an adjoining stage or stages.

The type of flooring described above was used for the first time by Republic Productions and permits any and all camera dolly shots without the necessity of having to lay dolly track. The finish-floor surface is level and perfectly noiseless under all production operation and present-day set construction equipment loads, which often are in the order of 15 tons distributed over four wheels. This requires floor construction capable of carrying live loads to the extent of 15/4 = 3.75 tons/sq ft.

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Selection of Replacement Equipment in Army and Air Force Theaters

By W. D. SHEPARD

The Army and Air Force Motion Picture Service is a self-supporting agency of the Department of Defense. Its mission is the presentation of entertainment motion pictures for morale purposes. Recent innovations in the industry necessitated a major replacement program. Methods of testing, bases of design and the determining effect of military operating conditions on choice of equipment are briefly described.

The Army and Air Force Motion Picture Service is an agency of the Department of Defense, supervising the operation of entertainment motion-picture theaters on Army and Air Force installations and procuring motion-picture programs and motion-picture equipment and supplies required in connection with the operation of those theaters. The AAFMPS is administered under generally accepted business principles. It provides entertainment and facilities of sufficiently good quality to encourage the soldiers and airmen to remain on the installation rather than seek less wholesome entertainment elsewhere. It is therefore imperative that the AAFMPS maintain its equipment to assure high-quality picture exhibition and sound reproduction.

The equipment-replacement policy is not based on any fixed depreciation rate. It is determined by the actual rate of physical deterioration or its obsolescence in the light of new developments of sufficient importance to render a change either necessary or very desirable in the interest of better service to the military personnel. Basically, every replacement must pay for itself either in dollars or in definitely improved results. Such a policy is flexible and can be described in terms of past replacements and existing future plans; but it cannot be reduced to any simple formula.

The equipment-replacement program that will now be described began as soon as it became apparent that at least some of the new techniques were permanent additions to the art and had box-office value. The program was planned as early and as carefully as the changing standards permitted, and in such a manner that no future development would be likely to render obsolete or inadvisable any previous step. It was necessarily spread over a sufficiently long period of time to permit its accomplishment with no increase in personnel. As a result, no reversal of policy was necessary at any time and no investment has failed to achieve its potential value.

Presented on May 2, 1957, at the Society's Convention at Washington, D.C., by W. D. Shepard, Army and Air Force Motion Picture Service, Bldg. 207C, Gate 14C, Goodfellow Blvd. and Elward St., St. Louis 20, Mo.
(This paper was received on April 9, 1957.)

Product Testing

It is appropriate to point out here that in the opinion of the Engineering Depot of the Service there is no best product or best type of product for all purposes. What is chosen for use in Army and Air Force theaters is that which is deemed best or fully satisfactory and most economical for the specific set of conditions under which it is to be used. The conditions of military operation may differ in many ways from those in most civilian houses. Actually, a considerable variety of types of equipment and the products of many manufacturers are in use.

Before buying any product, samples are inspected from the standpoint of construction and probable service problems, after which they may be subjected to appropriate tests. Screens are measured for gain, the polar diagram of light distribution is determined, and the surface is checked for durability. Lenses are tested for resolving power and aberration by means of targets, as well as by direct observation of projection. Amplifiers are tested for frequency response, output and distortion. Soundheads are subjected to flutter measurement.

Screens and Images

With the appearance of the new wide-screen techniques, it became apparent that drastic changes would have to be made in the method of presentation. Image size had been based on existing industry practice, generally from one-fifth to one-sixth of the maximum viewing distance. Civilian theaters were installing larger and larger screens, the size often limited only by the proscenium arch. But it appeared that images could be made too large. In some theaters, at least, the audience seemed to prefer the back rows. Perhaps there is no fixed maximum, but there undoubtedly is a degree of magnification that is too great for the quality of average film or lenses, or the steadiness of ordinary projectors, and it may well be that too large an image may at times appear inappropriate for some subject matter.

After some study, it was decided that a CinemaScope image of a width approximately one-third of the maximum viewing distance would generally be a satisfactory compromise. Smaller images would not be strikingly larger than those previously in use, and much larger ones seemed to present as many disadvantages as advantages. As it happened, architectural factors also were favorable to this proportion in most of the standard buildings. This decision with regard to image meant that there would be little change in image height. Obviously, any reduction would have had an unfavorable effect.

It was decided at this time that CinemaScope images would not be cropped or squeezed. It appeared not unreasonable that the specialists at the studios would have a better idea of what was to be portrayed and of requirements of composition than a projectionist or manager armed with an array of aperture plates. In rare cases, where screen width was severely limited by building construction and where a 2.35-to-1 aspect ratio would have resulted in a marked reduction in height, the image was cropped laterally by 5% and a 5% squeeze was introduced by means of a variable anamorphic lens. Although these small amounts are hardly detectable, this procedure was considered only the lesser of two evils and definitely to be avoided whenever possible.

It next became necessary to determine the image size and proportions for non-anamorphic projection. Different aspect ratios were recommended by different studios. It was realized that frequent changes in picture size, as dictated by the quality and photographic composition of each individual film, would lend interest or have publicity value in the civilian fields, but this was not considered either necessary or desirable for military theaters.

A survey of the product originally available showed that most of it had been photographed for the standard 1.37-to-1 aspect ratio, that it would usually be projected satisfactorily at 1.66, but that it frequently suffered at higher ratios. If experienced civilian projectionists sometimes had difficulty in framing up and down for satisfactory projection of close-ups, there seemed little likelihood that the enlisted projectionist would do better. The 1.66 aspect ratio was chosen, therefore, and the height was matched to that of the CinemaScope image. Early plans provided for a possible change to larger images for some pictures, but this has not proved to be either neces-

Needless to say, no one product could

quently could not be continued in use

strong contrast will tend to force itself

sary or, in view of the operating complications, desirable.

Probably as much misinformation has been circulated on the subject of screen curvature as on any other recent development. The problem, of course, is to determine what radius of curvature will provide the most uniform brightness over the greatest possible part of the seating area, or to decide whether the disadvantages of curvature might be seriously objectionable in any particular case. Because vertical viewing angles were small and very few of the theaters involved had projection angles exceeding about 5°, the problem of the apparent curvature of horizontal lines was virtually nonexistent. Since it was not necessary to fly the screens in crowded fly lofts, there was no other pressing reason for using a flat frame. Finally, because of the small projection and viewing angles, tilting of the screen to direct maximum reflection into the seating area proved to be unnecessary.

All that was necessary was a relatively simple drawing-board study of a few representative types of auditoriums. For this purpose, a few viewing positions were chosen: at the sides at front, center and back. The angle between the line of sight and a specularly reflected ray provides the means of reading, from the polar diagram of screen reflection, the relative brightness of that point of the image. By proper choice of curvature, the brightness of the near and far sides can be equalized. In practice, this calls for compromise in the interest of the best overall condition in the preferred seating areas.

As a consequence of this study, curved frames were installed in by far the greater number of theaters. Where very small images were used, flat white screens could be illuminated satisfactorily, and were provided. In those cases where curved screens were not desirable and where the images were large, lenticulated screens were installed. Their more uniform light distribution rendered curvature unnecessary though, generally, it was advantageous. While wood frames could be used, it was found from experience that they were heavy, subject to gradual changes in form and generally less desirable than metal, except in the smaller sizes. Almost all the frames were constructed of metal tubing.

Image brightness was another factor that required investigation in connection with screens and lamps. It was desired to operate within the recognized 9 to 14 ft-L limits. With white screens this represents no very great problem, since proper choice of lamps and arc current usually suffices, but it is far less simple with silver screens. Regardless of how the frame may be curved or tilted, it is impossible to achieve uniform brightness throughout the auditorium. The image will be brighter when viewed from the center of the seating area than from the sides, and it is very likely to be above the desired value at one point and below, at another. This condition can be alleviated by the use of lenticulated or semi-diffusive surfaces, but the greater cost may not always be justified. For economic reasons, use of white screens with larger lamps was not favored, although technically this is an excellent solution. For the same reason, although a considerable number of lenticulated screens were purchased, general use of this type could not be considered.

Fortunately, close adherence to the 9 to 14 ft-L recommendation is not essential. A brightness of 20 ft-L has been recommended by some, and even somewhat higher brightnesses can be used without introducing really excessive flicker and without serious degradation of contrast. Consequently, it was decided to accept higher values at the auditorium center in order to avoid undesirably low levels elsewhere. This had the advantage that lower-gain screens, with broader light-distribution characteristics, could be substituted as they became available, with an overall improvement in viewing conditions.

Projection Equipment

The lamps already in use were of two types: 1-kw lamps in the smaller theaters, and simplified high-intensity (using 7mm and 8mm Suprex carbons) in the larger. These were adequate since the largest screens were under 40 ft in width and could be illuminated within the desired limits without difficulty. Had the theaters required larger images, larger lamps would have been procured. This was done for some overseas theaters, whose great size required larger images, and larger lamps are planned for a theater now being designed. As it was, except for some transfers of existing lamps and power supplies or a change in carbon size, little new equipment proved necessary.

In the matter of lenses, the original problem of early delivery no longer exists. In a general way, projection lenses fell into 4- and 6-element categories. On the theory that the larger and better houses could afford the best lenses, and that in this manner limited funds could provide the greatest number of patrons with the best possible pictures, purchases were made from among a variety of makes and types. In the few instances where very long focal-length lenses were required with the larger screens and where light consequently was a problem, 4-in. diameter lenses were used. The alternative purchase of larger lamps, with their higher maintenance and operating cost, would have represented not only a greater original investment but a continuing expense. Anamorphic lenses, too, were purchased in different types and from several sources. As in the case of most other products, each design had it advantages and disadvantages, but al gave very satisfactory results. Both prismatic and cylindrical types are in use.

Sound

The CinemaScope process required a reorientation of thinking with regard to sound as well as picture. Because five changes of programs are needed each week, the product of all companies is required. Because some product was available only in magnetic form, it would not have been possible to disregard stereophonic sound even had it been desired to do so. Since this would constitute an expensive conversion concerning which controversy existed in the industry, it was decided to proceed slowly and with considerable caution.

The greater part of the existing sound equipment, although not new, was of excellent quality, but there were a fair number of installations that were becoming obsolete. It was therefore decided to procure a reasonable quantity of stereophonic equipment and install it in the more important theaters. The equipment thus released could be reconditioned and used to replace older or less desirable types. By this means, too, an appreciable reduction in spare parts stocked for emergency or routine repair purposes would be possible.

Well in advance of making any decision as to purchase, all available products were investigated. At this time, 3- or 4-channel magnetic equipment was simply being added to the optical sound systems already installed, which were sometimes utilized for the fourth channel. This appeared to be a rather poor engineering approach. If newer and better equipment was to be installed, it seemed that it would be preferable to use it with optical as well as magnetic sound, and to remove the older equipment entirely. By so doing, the number of controls could be reduced and operation generally simplified. This was an important factor, for in the Armed Forces men are frequently transferred and retention of the more experienced projectionists is not always possible. Manufacturers were approached with this in mind. Several were considering such designs, and they were available by the time the equipment was required.

In making the choice of equipment, consideration had to be given to a number of other factors, some of which might have been of somewhat less importance in theaters where fairly permanent and fully experienced projectionists would always be available. Simplicity of controls, easy replacement of individual units, ease of assembly and wiring, presence of complete standby channels with simple emergency switching, availability for prompt delivery and, of course, a satisfactorily low price combined with the best possible quality were desired.

Needless to say, no one product could be expected to be superior in all of these respects. The choice, therefore, represented the best compromise possible at the time from this particular point of view and for the contemplated conditions of operation.

Altogether, about 25% of the Army and Air Force theaters in this country have been converted to magnetic stereophonic sound, which is comparable to the percentage in civilian theaters. Inasmuch as magnetic prints are not as readily available as might be desired, no conversions are being made at present, although all new theater designs are being so made that such equipment can be installed at any time.

The projector program has been entirely different. The new processes have necessitated no changes other than relatively simple field modifications. The existing policy of gradual replacement of older machines remained unchanged. Projectors take a very long time to wear out and by proper maintenance can be continued in service almost indefinitely. However, new models appear from time to time and frequently have distinctly superior features. It would, therefore, appear to be uneconomical to replace projectors after too short a period of service, and technologically unwise not to replace them as definite improvements reach the market. At the same time, utilization of too many types at any one time has disadvantages, for repair and emergency parts stocks must be maintained for each model, or as an alternative, purchases would have to be made where and as needed. The established policy, therefore, is to maintain a gradual replacement program, with the older machines being retired at a rate partially determined by the desirability of currently available models. Customarily, the latest model is utilized in the larger and better theaters, and older types are transferred to the less important situations as convenience permits.

Stage Settings

Directly connected with the new processes is the modernization of stage equipment. The new screens often had to be in new locations because of dimensional changes. Screen curtains required replacement, and other draperies frequently could not be continued in use or could no longer serve their purposes effectively. The replacement of curtains and stage settings has been gradual and is still under way. All materials must be flameproof, and to eliminate the cost of periodic reflameproofing, durable processing is used. At the present time, this is difficult to apply to velours, but several flat fabrics present an excellent appearance.

It is important that at least one theater on each large military installation be suitable for the presentation of stage shows. Very few have fly lofts sufficiently high to accommodate the screen. Screens had to be retracted by hanging them on arms pivoted at the back wall so that they could be lifted and drawn back in one operation. It was found that reasonably strong metal frames could be retracted in this manner without great difficulty. In other cases, the frames were mounted on rollers.

It was decided to mask to the largest image size. Movable masking, while undoubtedly presenting the best appearance, leaves something to be desired unless experienced personnel are always at hand to keep it in proper trim, for any imperfection will be painfully apparent. For some years, this Service has been using gray instead of black masking. This does not contrast strongly with aluminum screen surfaces, which also have some advantage in that they do not reflect house lighting in the direction of the seating areas and they appear darker than white screens under diffuse lighting. Under these conditions, unmasked screen areas are hardly noticeable and have no ill effects. Large unused areas, of course, are concealed by the screen curtains, which can be stopped just outside the picture area by means of stop-start-reverse curtain controls.

It will be recalled that for some years the subject of masking has been under discussion. Studies, made by agencies independent of the motion-picture industry, have shown that a bright working area surrounded by darkness leads to poor viewing or even eye fatigue. Aesthetically it has been argued with good reason that a greater feeling of participation in screen action exists if the attention is not diverted from the picture by extreme brightness contrasts at the edge, for any strong contrast will tend to force itself on the consciousness. Ideally, it would appear that the edges of the image should simply fade from view. The choice of gray masking (and screen surrounds of fairly neutral color) was made to minimize these contrasts. If the favorable reception accorded it in the theaters has validity, it has accomplished its purpose.

16mm Equipment

About five years ago, it was decided to institute 16mm service for small military installations where 35mm service was not feasible.

At first, surplus 16mm projectors were made available provided maintenance was taken care of by the AAFMPS. The machines were old and repair costs proved to be excessive. They have gradually been replaced by new projectors and at present only a few old ones remain in use. These will probably be replaced within the next year or so, for some parts are no longer in production. Following this, replacement will be relatively slow until aging and normal wear and tear begin to take effect. No attempt can be made to forecast this date until the repair experience begins to indicate its approach. Although 16mm projectors cannot compare in durability with 35mm machines, the life in other than portable service is expected to be a considerable number of years. About all that can be said on average life is that it is extremely variable, depending on conditions of use.

Finally, there is the question of planning for the future. The replacement program is again approaching what might be called a condition of stability, for the requirements of the new processes have been largely met. But this does not mean that the program is at an end. Improvements are always being put into effect, and equipment continues to become obsolete. No industry can stand still if it is to remain healthy in the face of new forms of competition. While we may hope for a reasonable period of standardization, we must expect new developments at some future time. The Army and Air Force Motion Picture Service is prepared to keep abreast of the industry, but it will be the responsibility of private enterprise to pioneer the development.

motion-picture standards

Proposed Revision of American Standard Z22.28-1946

PH22.28, Focal Lengths and Markings of 35mm Motion-Picture Projection Lenses

A proposed revision of American Standard Z22.28-1946 is published here for a three-month period of trial and criticism.

The first draft of the proposed revision of the 1946 standard was approved by the Film Projection Practice Committee in June 1954 and by the Standards Committee in August 1954, and was published for trial and comment in the September 1954 *Journal*. Three of the previous six specifications were eliminated from that draft because they were not considered prerequisites for interchangeability. These specifications dealt with the projection angle, the lens light path and the observation port. In February 1955, that proposal went to letter ballot of ASA Sectional Committee PH22. A number of negative votes and adverse comments there led to its return to the Film Projection Practice Committee for further work.

In February 1957, a new draft was approved by the Film Projection Practice Committee. This new draft differed from the previous one as follows:

1. Addition of a section defining the scope of the standard.
2. The increments in the focal length of lenses are specified for lenses only up to 7 in.
3. Addition of an Appendix to provide information with respect to the increments in the focal length of lenses over 7 in.
4. The specification on the marking of lenses has been made more general.
5. The specification of the height of the optical axis of the lens from the floor has been deleted for these reasons:
   (a) It is only obliquely pertinent in a standard on lenses.
   (b) It has real significance only when a projector is at 0° tilt, a condition rarely found in motion-picture theaters.

This draft was approved by the Standards Committee in April 1957 and is the one published here for comment. All comments should be sent to the Staff Engineer prior to August 15, 1957. If no adverse comments are received, the proposal will then be submitted to ASA Sectional Committee PH22 for further processing as an American Standard.—*Staff Engineer.*

Proposed American Standard

Focal Lengths and Markings of 35mm Motion-Picture Projection Lenses

PH22.28

Revision of Z22.28-1946

1. Scope

1.1 This standard specifies for the lenses used in 35mm motion-picture projectors:

(a) The increments in the focal length of up to 7-in. focal length lenses (see Appendix).

(b) The permissive tolerance between actual and designated focal length.

(c) The marking on the lenses.

2. Focal Length

2.1 The focal length shall increase in ¼-in. steps up to 7 in. (see Appendix for increments above 7 in.).

2.2 The actual focal length shall not differ from the value marked on the lens by more than ± 1%.

3. Marking

3.1 The focal length of the lens shall be marked on the lens barrel.

APPENDIX

Practices on lenses greater than 7 in. in focal length differ with the different manufacturers. The increments are either ¼-in. or ½-in. steps, depending on the manufacturer.

NOT APPROVED

Reaffirmation of American Standard

Z22.79-1950, 16mm Sound Projector Test Film, was reviewed by the 16mm and 8mm Committee, Standards Committee, PH22, and on December 12, 1956, it was reaffirmed without change by the ASA as PH22.79-1950. Copies of this standard are available at twenty-five cents each on order from the American Standards Association, Incorporated, 70 East 45 St., New York 17.

news and reports

Fall Convention—Papers Program

At Philadelphia, October 4–9, Friday through Wednesday, there will be papers sessions on five forenoons, five afternoons and one evening. Whether there will be some concurrent sessions, to bring the total above eleven sessions, is still to be determined.

Papers are grouped into convention sessions chiefly on the basis of topics. Initial plans include 14 general topics which will be fitted into 11 or more sessions — but no paper of general merit and of interest to the Society's membership will be excluded because it does not exactly fit under the suggested topics for the 82d Convention. Author Forms for submitting papers can always be obtained from the Editor at Society Headquarters.

The Papers Program is one of the responsibilities of the Society's elected Editorial Vice-President, *Glenn E. Matthews*, Research Laboratories, Bldg. 59, Kodak Park, Eastman Kodak Co., Rochester 4, N.Y.

Papers Committee Chairman, responsible generally for all papers activity, is *Bernard D. Plakun*, General Precision Laboratory Inc., Pleasantville, N.Y. He is responsible for the two papers programs for conventions each year and for contributions to the *Journal*. Mr. Plakun's committee is made up of 10 Regional Chairmen whose job is to search for papers and cover the field on a geographic basis. These Chairmen supply information to the Program Chairman about possibilities for papers from firms in their areas. Judgment must be exercised about advising a proper Topic Chairman at the same time as the Program Chairman. When Author Forms are executed, a copy is sent to both the Topic Chairman and the Program Chairman. The Regional Chairmen are:

J. E. Aiken, (Washington area), 116 N. Galveston St., Arlington 3, Va.
Ben Akerman, (Atlanta area), 2624 Cheshire Bridge Rd., N.E., Atlanta 5, Ga.
Herbert E. Farmer, (Hollywood area), 7826 Dumbarton Ave., Los Angeles 45.
C. L. Graham, (Rochester area), Color Technology Dept., Kodak Park, Eastman Kodak Co., Rochester 12, N.Y.
C. E. Heppberger, (Chicago area), 510 White Oak Dr., Naperville, Ill.
R. A. Isberg, (San Francisco area), 2001 Barbara Dr., Palo Alto, Calif.
Everett Miller, (New York area), Film Recording, Radio Corp. of America, 411 Fifth Ave., New York 16.
Ira L. Miller, Jr., (Dallas-Ft. Worth area), Miller's Visual Aids, 519 Pennsylvania Ave., Ft. Worth, Tex.
Rodger J. Ross, (Canada area), 784 Duchess Dr., Applewood Acres, Port Credit, Ont., Canada.
Deane R. White, (New Jersey/Philadelphia area, and 82d Program Chairman), E. I. du Pont de Nemours & Co., Parlin, N. J.

Papers for each convention are assembled by a Program Chairman who is also the Regional Chairman in the area of the convention. For Philadelphia, the Chairman is *Dr. Deane R. White*, Photo Products Dept., E. I. du Pont de Nemours & Co., Parlin, N.J.

TOPIC CHAIRMEN

Working under Dr. White are the 82d Convention Topic Chairmen listed below. Their duties are to plan, gather and report to the Program Chairman, a group of papers of sufficient quality and quantity to constitute proper coverage of the topic. The quality of the papers should be such that they are good prospects for *Journal* publication, unless an author's contribution is to be essentially a demonstration or a film. Particularly desirable are papers which deal with development trends in the industry and timely tutorial papers.

Instructions about the general preparation of papers and planning oral delivery are supplied by the Program Chairman. Author Forms are also available from these Topic Chairmen:

Bilingual Films for Intercontinental Television, *Ellis W. D'Arcy*, Box 1103, Ogden Dunes, Gary, Ind.
Closed-Circuit Television, *Herbert Barnett*, General Precision Equipment Corp., 92 Gold St., New York 38.
Color Photography, *J. Paul Weiss*, Photo Products Dept., E. I. du Pont de Nemours & Co., Parlin, N.J.
Film Projection Practice, *H. E. Behrens*, 31 Sheridan Ave., Metuchen, N.J.
High-Speed Photography, *D. Max Beard*, 10703 E. Nolcrest Dr., Silver Spring, Md.
Industry Milestones, *J. B. McCullough*, Motion Picture Assn. of America, 28 W. 44 St., New York 36.
Laboratory Practice, *John G. Stott*, Eastman Kodak Co., 343 State St., Rochester 4, N.Y.
Military Uses of Television, *Max C. Batsel*, Radio Corp. of America, Bldg. 15–7, Camden, N.J.
Projection Television, *Frank L. Marx*, American Broadcasting Co., 7 W. 66 St., New York 23.
Sound Recording, *Edward Schmidt*, Reeves Soundcraft, 671 Hope St., Springdale, Conn.
Studio Lighting, *Petro Vlahos*, Motion Picture Research Council, 6660 Santa Monica Blvd., Los Angeles 38.
Television Film Reproduction Technique, ———
Television Studio Practices, ———
Video Tape Recording, *Dr. George H. Brown*, Radio Corp. of America, Camden, N.J.

DEADLINES

Before August 1, the Program Chairman must have received from prospective Program authors: the Author Form, 3 copies of a 50- to 75-word abstract, typed double-spaced, and two self-addressed business-size envelopes.

Before August 30, copies of the manuscript and brief biographical information, as described on the Author Forms, are due the Program Chairman, the Editor and Publicity Director.

All suggestions and proposals are welcome. No member or person interested in the Society's activities and concerns need hesitate to suggest a paper that might be presented, or to suggest a subject he would like to hear on the Program. Complete information and Author Forms are available from Society Headquarters and from any of those mentioned above.

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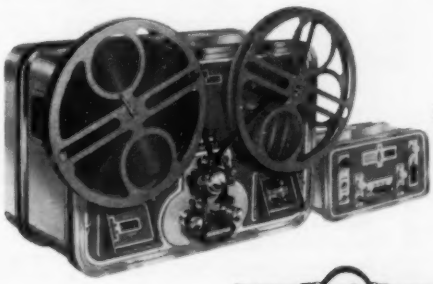

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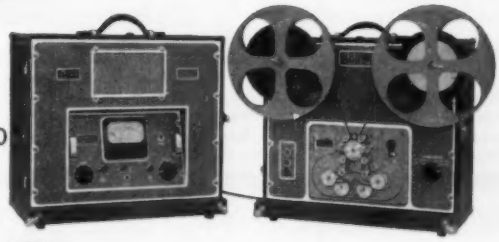

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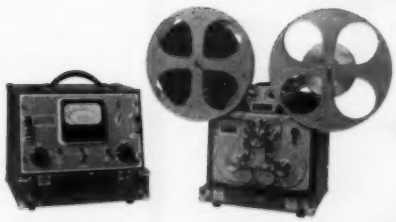

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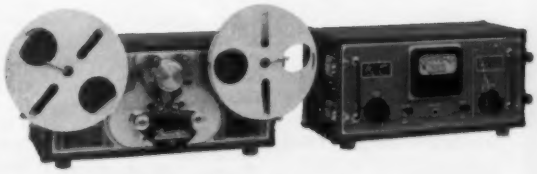

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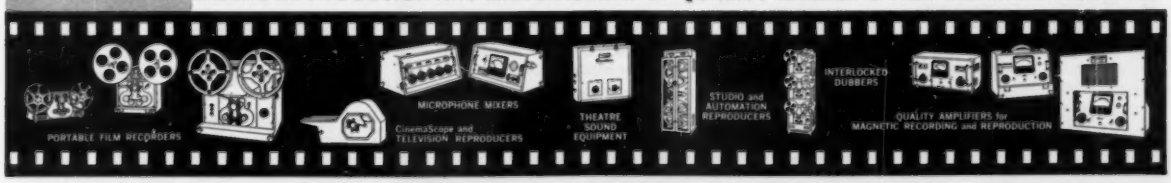

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SMPTE Staff Engineer

Henry Kogel, SMPTE Staff Engineer, resigned as of April 12 to accept a position with Century Lighting Co., New York.

"Hank" was on the staff of the Society since November 1950. During that time he became nationally known for his contributions to the standardization program and received international recognition as Technical Secretary of ISO/TC 36 on Cinematography. He also served as Secretary of the American Standards Association and Secretary of Committee PH22.

Before his SMPTE appointment he was with Sperry Gyroscope Co. where, as project engineer, he engaged in developmental work on demodulators, electronic and magnetic amplifiers and instrument servomechanisms. His scholastic career was interrupted by five years of military service (1941–46) where he was attached to the Army Signal Corps and worked in radio communications. He was graduated from Columbia University in 1948 with the degree of Bachelor of Science in Electrical Engineering.

In his new position he is devoting his attention to the field of lighting for television. —*R.H.*

Education, Industry News

Society Educational Program

Two SMPTE-sponsored courses at New York University and three on the West Coast are being given as part of the Society's educational program.

On the West Coast, this phase of the Society's long-range educational plans was begun in the Fall of 1955 with three courses at the University of California, Los Angeles, and one at the University of Southern California. Courses in Illumination Optics, Motion Picture Laboratory Practice, and Color Duplication were given at UCLA; and a course in Elements of Sound Recording for Motion Pictures was given at USC.

The success of these courses assured the continuation of the West Coast program and with the beginning of the 1956 Fall Semester three courses were offered. Elements of Sound Recording is being repeated at USC. The present instructor is Frank Pontius of Westrex, who is conducting the course under the direction of Herbert Farmer. A course in Electrical and Electronic Principles of Sound is being given at UCLA, with Jerry Paskusz as instructor; and S. P. Solow is conducting a course in Laboratory Practice and Color Duplication. This course does not carry college credit.

Sound Recording and Laboratory Practice courses opened at New York University in February. The tremendous response when the courses were first announced made it necessary to limit the classes to students who could meet certain strict requirements, but even with the limitations the quotas were rapidly filled. The course in Sound Recording is co-sponsored by the Society and I.A.T.S.E. Local 52.

Moderator for the Sound Recording course is Burton F. Perry, Westrex Corp., while moderator for the course in Labora-

tory Practice is Ralph D. Whitmore, Mechanical Engineer, Twentieth Century-Fox.

Instructors for the two courses were selected from top men in the industry, each of whom lectured on his specialty. Instructors in Sound Recording are: Nicholas B. Cook, Chief Engineer of Meters, Public Service Electric and Gas Co., Clifton, N. J.; Prof. Cyril Harris, Supervisor, Acoustics Laboratory, Columbia University; Raymond Griswold, Chief Recording Engineer, Film Recording, Radio Corp. of America; Homer Elder, Chief Engineer, Metropolitan Sound Service, Inc.; Robert J. Engler, Systems Engineer, Westrex Corp.; Edward P. Ancona, Film Recording, Radio Corp. of America; Edward Schmidt and Ernest Frank, Reeves Soundcraft Corp.; John Maurer, President, JM Developments Co.; Richard J. Boricek and Emil Neroda, Reeves Sound Studios.

Instructors for the Laboratory Practice course are: Dr. A. F. Turner, Head of Vacuum Coating Dept., Scientific Bureau, Bausch & Lomb; Wilton R. Holm, Technical Associate, Photo Products Dept., E. I. du Pont de Nemours & Co.; John J. Kowalak, Process Engineer, Movielab Film Laboratories, Inc.; Arthur J. Miller, General Manager, Pathé Laboratories, Inc.; Edward M. Warnecke, Motion Picture Film Dept., Eastman Kodak Co.; and George H. Gordon, Motion Picture Film Dept., Eastman Kodak Co.

Educators at New York University have expressed themselves as being greatly pleased with the way the courses have been conducted. The use of training aids was mentioned especially as having high educational value in this type of instruction—*R.H.*

The Scientific Film Association

This Association, whose offices are at 164 Shaftesbury Ave., London W.C.2, states that it exists to study, discuss and publicize the use of scientific and industrial films. It is governed by a Council of Management, composed of the officers of the Association and six other members, all of whom are elected annually, and seven members appointed on the nomination of the Lord President of the Council. The Council of Management appoints Standing Committees which deal with various aspects of the Association's work. These are at present the Film Appraisal Committee, the Industrial Committee, the Medical Committee and the Sciences Committee.

There are three grades of membership, Associate, Full and Corporate; the first entitles the member to attend meetings, the last two entitle him to vote and to receive the Association's publications.

Scientific Film Review, the journal of the S.F.A., is a 5½ × 8½-in. magazine of about 50 pages, now in its third year of publication, is published every other month, beginning with February, and is available to nonmembers on a subscription basis. Three issues each year contain reviews and appraisals of scientific and industrial films, special lists of films (e.g. automation, medical and veterinary subjects, Polar exploration, etc.), articles on the development and

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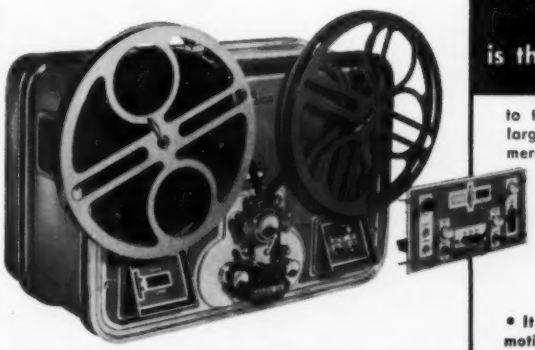

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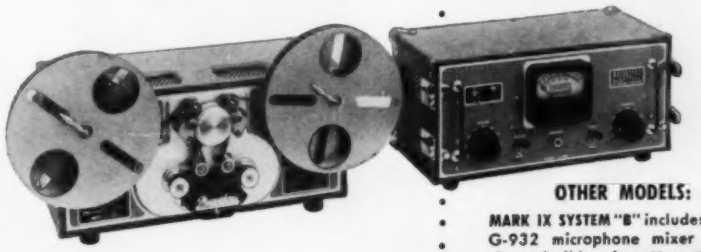

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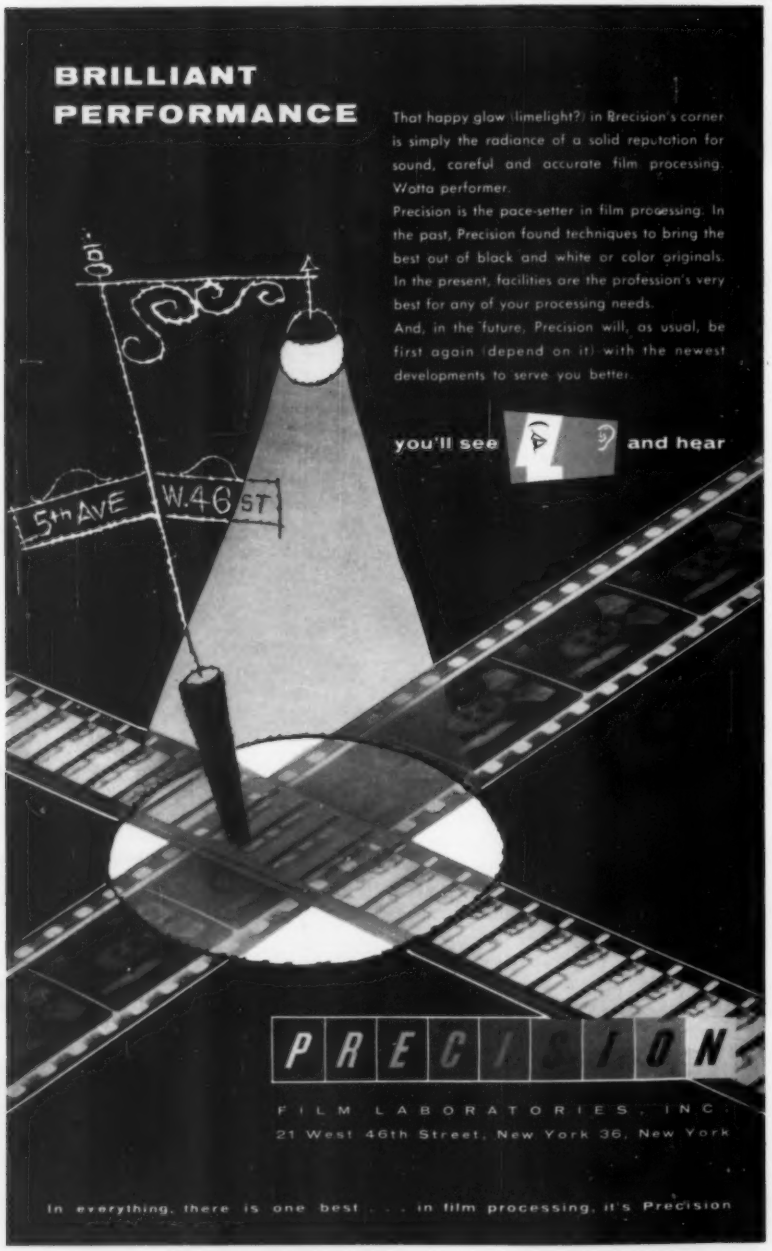
use of such films, details of S.F.A. activities, and other information of interest to all concerned with the application of films to scientific and industrial problems. The other three issues are usually devoted to films on specific subjects (e.g. atomic energy, building and construction, chemistry, economics, industrial training, physics, etc.)

The S.F.A. also distributes, free to its full and corporate members, *Science and Film*, which is the quarterly journal of the International Scientific Film Association, whose headquarters are in Paris (37 Ave. des Ternes, Paris 17). This publication, which is in a format similar to that of the *Scientific Film Review*, is in its sixth volume. It contains articles from contributors all over the world, who discuss the development and use of scientific and industrial films in their respective countries.

Through viewing panels, meeting in London as well as in other parts of England, the S.F.A. makes critical appraisals of scientific and industrial films, indicating suitability for various types of audience. These findings are used in compiling catalogs of films by subject matter, which are sold by the Association as a working tool for film users.

SMPTE Lapel Pins. Gold and blue enamel reproductions of the Society symbol, with screw back. Available to all members from Society headquarters. Price $4.00 including Federal Tax; in New York City, add 3% sales tax.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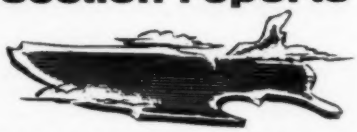
section reports



The Hollywood Section met on March 19 at the ABC Television Center, Hollywood, with an attendance of approximately 275. The meeting was opened with a 16mm color film supplied by Douglas Aircraft Co., *The Navy's F4D Skyray, Spearhead of Defense.*

Marvin B. Jacobs, television and optics engineer for American Broadcasting Co., gave an excellent talk and demonstration of the 100-in. lens employing reflecting, telescope-type, optics, and having an effective aperture of approximately $f/5.7$. The TV camera was focused on an RETMA test chart approximately 90 ft away, to show the excellent definition and freedom from distortion achieved with this unique lens. This lens was developed by ABC and used at the Republican National Convention and at the recent presidential inauguration in Washington, D.C.

A. W. Vose, of Radio Corp. of America, gave a talk, illustrated by slides, on the development and implimentation of the RCA AVQ-10 Weather Radar. This radar permits a pilot to "look" ahead of his flight up to 150 miles to determine the best course for avoiding thunder storms and for penetrating storm fronts and squall lines.

United Airlines needed a pilot training film to acquaint pilots with the proper operation of the RCA weather radar. This film was produced by Thomas J. Barbre Productions in Denver. Some of the unusual production problems, including the radar scope photography necessary in this production, were described by Paul Emrich of the Barbre Company. This talk was followed by the showing of the 40-min, 16mm color film *United's New Look* which was filmed from a United Airlines Convairliner on a trip over the midwest plains states through thunderstorm activity. The film showed views of the thunderheads taken from the airliner cabin and then showed their presentation on the weather radar scope. The commentary on the soundtrack, provided by a United Airlines radar expert, described the various pertinent details on the radar scope that enabled the pilot to analyze the severity of the various cells in the storm and to find a corridor for safe penetration of the storm area.—*Robert G. Hufford*, Secretary-Treasurer, c/o Eastman Kodak Co., 6706 Santa Monica Blvd., Hollywood 38.

The Chicago Section met on February 28 at the Processing Laboratory, Eastman Kodak Co., Chicago, with an attendance of about 400.

Three papers were presented by members of the technical staff of the Eastman Kodak Processing Laboratory. The first paper, "Silver Recovery and Solution Rejuvenation," by Frank E. White, Supervisor of Engineering Maintenance, covered various methods for the recovery of chemicals and silver from exhausted solution. In "Color Processing Control Techniques" Atwood G. DeCoster, Supervisor, Quality

tion, etc.), articles on the development and

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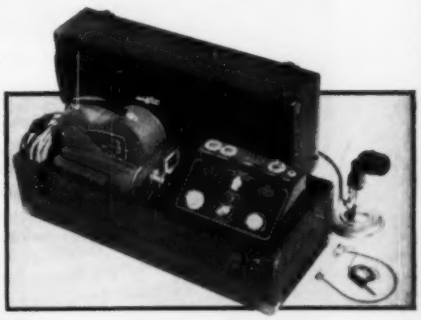

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Control, described the photographic, chemical and mechanical controls necessary to assure color process stability. George C. Myers told "How to Make Kodachrome Photographic Prints From Color Transparencies," in a paper describing in detail the techniques involved.

Following presentation of the papers, the group was taken on an inspection tour of the Laboratory. Ten stations were set up throughout the plant where summaries of the operation were presented by members of the Eastman Kodak staff.—*H.H. Brauer*, Secretary-Treasurer, c/o Bell & Howell Co., 7100 McCormick Rd., Chicago 45.

The Chicago Section met on March 27 at the Prudential Building with an attendance of 65. Speakers were O. H. Coelln, Editor and Publisher of *Business Screen*, and Otto Rauhut of Wide Range Recording Co.

Mr. Coelln, who spoke on "New Horizons in Production: The Road Ahead for Business Film Producers and Sponsors," showed sections of several outstanding films from the sponsored film field. These illustrated the sort of opportunities available to sponsors. One film was screened before more than 42 million people in 1956. The speaker explained that the sponsored film is a rapidly growing field, with approximately 215 producers in 1956, as compared with 180–200 in 1955.

This group, Mr. Coelln said, produces about a thousand 16mm sound films a year. There are 50 to 100 prints of the average film, although releases of 350–400 are now being made. Mr. Coelln emphasized the desirability of 350–400 prints, in order to cut down on the waiting time for a film. At the present time, sponsors are obtaining, on the average, about four showings per print per month. Efforts are being made to speed up the handling of prints. TV prints, Mr. Coelln emphasized, are just beginning to emerge. This field, he said, offers an exciting and dynamic opportunity to all producers.

In the second paper, "A Magnetic Film Sound Recorder of Advanced Design," Mr. Rauhut reviewed the design features of a new magnetic film sound recorder. Some of the advance features of this equipment include recording on either 16mm or 17½mm film, two-speed operation with the flip of a key switch, and low wow-flutter performance—*H. H. Brauer*, Secretary-Treasurer, c/o Bell & Howell Co., 7100 McCormick Rd., Chicago 45.

The Rochester Section met March 28, at the Gallery Theater in the Memorial Art Gallery, Rochester. The unusual program featured a talk on "Building Modern High-Fidelity Systems With Components" by Fred P. Beguin, General Electric Co., Syracuse. Mr. Beguin brought a considerable amount of equipment with which he demonstrated stereophonic sound, binaural sound, etc. The meeting announcement had extended an invitation to members to bring along favorite records.—*A. E. Neumer*, Secretary-Treasurer, c/o Wollensak Optical Co., 850 Hudson Ave., Rochester 5, N. Y.

The Canadian Section held its first meeting March 28 at the Toronto Office of the National Film Board. Sixty-five members and guests heard Ethan M. Stifle, SMPTE Sections Vice-President, explain the programs and objectives of the Society.

Don Dixon of Eastman Kodak was named to succeed Ron Ringler of Du Pont as Membership Chairman, and Ivor Lomas of Crawley Films was appointed Program Chairman. The Interim Board of Officers of the Canadian Section will hold their positions until the Fall election.

The Board is as follows: Chairman, R. J. Beaudry, Shelly Films Ltd.; Secretary-Treasurer, R. E. Ringler, Du Pont of Canada; Board of Managers, Ray Payne, National Film Board; Lou Wise, AVRO Canada; R. Laidlaw, CFPL-TV; D. Spring, Canadian Kodak; N. Olding, CBC; and I. Lomas, Crawley Films.—*R. E. Ringler*, Secretary-Treasurer, c/o Du Pont Co. of Canada (1956) Ltd., 85 Eglinton Ave., E. Toronto, Canada.

The San Francisco Section, at an interesting and unusual meeting on April 9 at Leo Diner Films, heard papers on audio-visual education in our public schools.

Carl B. Manner, Director of Audio-Visual Education in the Vallejo School System, described the program in effect

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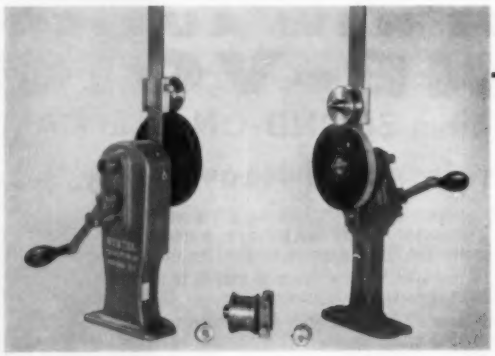

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NS-14-WTW

NS-30-WTW shows the Wenzel Supreme 1957 Model Hand Rewind, 4–1 Ratio. Clockwise rotation of handle. Reel shaft can be changed in seconds from 16 mm to 35 mm or vice versa. It is equipped with the Wenzel Tite Wind, WTW.

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in his area, illustrating his talk with examples of the visual aids employed. He also had on hand a variety of new equipment that is used in the schools today.

Bill A. High, Director of Photography for the Oakland Junior College, gave a talk on the standards which must be met to pass the College's two-year course in photography. Mr. High brought with him a series of pictures produced by the students of the school with which he pointed out that the school is concerned with commercial aspects rather than the fine arts. The work of the classes covers approximately 80% still and 20% motion-picture photography, and quality is kept very high.

Leo Diner, of Leo Diner Films, wound up the meeting with an informal rundown on some of the highlights of his recent tour of duty with the San Francisco Ballet in the Far East. Mr. Diner was in charge of the tape sound equipment on the trip. It was promised that at a future meeting he would give a complete account, with some of the many slides and motion pictures taken during the tour.—*Werner H. Ruhl*, Secretary-Treasurer, 415 Moline Dr., San Francisco, Calif.

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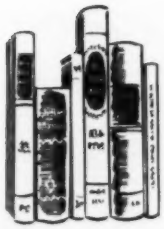

books reviewed

Television Engineering Handbook

Donald G. Fink (Editor). Published (1957) by McGraw-Hill Book Co., 330 W. 42 St., New York 36. 1483 pp. + 22 pp. index, Illus. 6 × 9 in. Price $18.00.

The intent of Don Fink in preparing the *Television Engineering Handbook* can best be expressed by the following quotation from its Preface:

"The development of the techniques of television engineering, following the establishment of the compatible color system in the United States and the extension of monochrome broadcasting throughout the world in four major systems based on different standards, has reached such a point that no individual engineer can command all of the quantitative data required to design and operate television equipment. This situation has two consequences: there is a need for a unified compilation of these data, and the compilation must be prepared by a team of specialists. The *Television Engineering Handbook* is intended to fill this need."

The degree to which this objective has been attained is suggested by this list of the chapter headings: (1) Numbers, Equations, and Definitions; (2) Television Standards; (3) Monochrome Vision, Photometry, Illumination, and Optics; (4) Color Vision and Colorimetry; (5) Cathode-Ray Devices; (6) Scanning, Deflection, and Color Registration; (7) Synchronization of Scanning and Color Coding; (8) Transmission of Monochrome Information; (9) Transmission of Chrominance Values; (10) Composite Video Signals, Waveforms, and Spectra; (11) Video Amplification and D-C Restoration; (12) Wideband Amplification (Radio and Intermediate Frequency); (13) Wideband Modulation and Demodulation; (14) Wave Propagation, Radiation, and Absorption; (15) Television Receivers — Circuit Functions and Block Diagrams; (16) Television Receivers — Circuit Design and Component Specification; (17) Camera Chains and Related Equipment: Part I — Monochrome Systems, Part II — Color Terminal Equipment; (18) Coaxial Cables, Microwave Links, Relays, and Networks; (19) Television Transmitters and Auxiliary Equipment; and (20) Transmission Lines and Radiators.

The first chapter is written in true handbook form, that is, the material in this chapter represents a collection of facts and figures with a bare minimum of descriptive or expository material. The remainder of the book, however, consists of a number of essays on various phases of the problems arising in television engineering. This

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method of handbook writing has both advantages and disadvantages for the user of the book. The reader in search of information can find it readily in case the author of a particular section is a good writer, that is, where a chapter has been carefully prepared so that the important facts are clearly marshaled in an orderly fashion and the writing is clear and succinct. Most of the chapters in this book show that between the individual author's efforts and the skill of the editor this desirable objective has been met.

There is, however, one exception to this desirable state of affairs. Some of the material in the chapter "Transmission of Monochrome Information" is treated from an entirely new and untried point of view. Consequently, this treatment, which may have seemed completely clear and obvious to the author, must be studied carefully if the reader even is to comprehend the purpose of the presentation. In this case, it appears to this reviewer that it would have been wiser if the conventional approach to this problem had been followed for this handbook and the new approach better tried on a large technical audience before it was considered as handbook material.

The chapter "Composite Video Signals, Waveforms and Spectra" lies at the other extreme. Here the authors have presented new data in a clear, concise and straightforward style. One cannot question the interest of all television engineers in the detailed spectrum analyses of television signals which are shown in this chapter. It is this reviewer's hope that these data will be published in one of the technical journals so that every interested engineer can become aware of their existence.

For many engineers this handbook will become a working tool taking its place alongside his pencil and slide rule. These engineers will represent a large fraction of those working in the television field, for the variety of facets of television engineering covered and the detailed treatment of each will satisfy most of the practicing engineers. Even so, there are some significant omissions.

This reviewer was surprised to discover that the chapter on "Television Receivers —Circuit Design and Component Specification" contained no material on the design of circuits for receivers using the Lawrence color picture tube. The theory of operation of this tube is described in other sections of the *Handbook* and, except for the shadow-mask type of tube, probably more receivers have been built to use it than any other known type of color display tube.

Other subjects omitted from the *Handbook* are industrial and closed-circuit television, projection receivers for use in auditoriums, kinescope or videotape recording, and community antenna systems. There are many television engineers who are concerned with each one of these topics.

Another subject which would be useful to many television engineers is that of requirements for the design of television systems. For many purposes, it is desirable to know the threshold and tolerable values of noise, echoes, interference and other defects arising in picture transmission.

This reviewer was somewhat troubled by the fact that no references or bibliography was included in chapters 12, 15, several sections of chapter 16, and chapter 19 of the *Handbook*. This was particularly distressing in the case of chapter 12 "Wideband Amplification (Radio and Intermediate Frequency)." The synthesis of broadband circuits by studying the location of poles and zeros is a technique which has been developed by mathematicians and circuit engineers over the whole world during the last 20 to 30 years, and references to these prior workers seem necessary to this reviewer if a complete picture of the art is to be presented.

Since this *Handbook* is in its first edition, it does contain errors. In spite of such errors, in spite of the shortcomings pointed out above, this reviewer can give his unqualified recommendation that this book belongs on every television engineer's bookshelf.—*W. T. Wintringham*, Bell Telephone Laboratories, Inc., Murray Hill, N.J.

Die Technik für Filmvorführer, 2d Ed.

By Karl Rower. Published (1957) by VEB Wilhelm Knapp Verlag, Halle (Saale), Germany. 6 × 8¼ in. 352 pp., 257 illus. Tables. Price: DM 16.–.

This book is written very much on the order of our American *Blue Book on Projection* by F. H. Richardson and compares favorably with it although the correction of sound reproduction troubles is discussed rather ineffectively. Due to the quality of the paper and print, the reproduction of the illustrations is not always good.

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Since the book is primarily intended to be a textbook at the East German "Central School for Projectionists of the Department of Culture," it contains all the information needed by projectionists, as required by the East German law of December 8, 1954. This information consists of:

General knowledge of acoustics and optics;
Electrical installations needed for theaters;
Detection and elimination of troubles in electric equipment;
Film properties and handling of film;
Servicing of the commonly used projectors;
Safety, police and fire regulations;
Plant and workmen's protection.

Remarkable are two items which are unusual requirements for us.

(1) Standard identification of theater prints (DIN 5381) consisting of colored paper bands on film rolls identifying them as the first, second, third news reel, the first or second roll propaganda reel and first to sixth reels of the main feature.

(2) One of the subject matters of the exam to become a projectionist is "the knowledge of the duties of the projectionist as an agitator."

Among other important features are the following items:

(3) The recommendations for the careful treatment of theater prints:

a. Standard nomenclature chart of defects.

b. Checking on a rewind every newly received roll before the first performance. Perforation damage and scratches have to be noted. Badly damaged perforations might cause fire, when the film is stopped in the gate.

c. Careful rewinding: Prints are damaged more frequently during rewinding, than during normal projection — unless the projector itself is in poor shape. Scratches might be introduced, mainly horizontal ones, when after rewinding, telescoping rolls are pressed or pounded. Good motor driven rewinds are therefore preferred to hand-rewinds. These should be built so that the friction depends on the weight, whereby a rather constant winding tension is obtained.

d. For a performance only reels with standard core should be used. They should be always in good shape, mainly they should not be bent. So-called "stick-up reels" (shipping reels) are not permitted since during unwinding the film roll strikes, whereby the film suffers.

e. Storage should always be according to regulations. Whatever is not actually on the projector should be in a partitioned hardwood cabinet. The film should never be exposed to excessive heat or humidity.

(4) There are at least two projectors manufactured with combined air and water cooling: the Zeiss-Ikon VIIB and the Ernemann X.

(5) Examples of good 16mm professional projection systems are listed. These projectors are required to meet nitrate standards for safe operation; this fact together with inferences in other parts of the handbook suggest that some 16mm nitrate film might be in use in "iron-curtain" countries which is directly opposed to practice in this and many other countries.

(6) Among the published tables the following are of interest to us:

Two tables contain symbols used on German electric diagrams and blueprints.

Film weight table shows length in meters vs. weight in kilograms.

Length of film vs. roll diameter when cores of 1.417 in., 1.969 in., 2.953 in., 4.134 in., 4.724 in. and 5.000 in. in diameter were used.

The last table gives running times for given length of rolls.

(7) Many of the published recommendations shed light on conditions in East Germany and probably in the U.S.S.R. also.

Building, electrical regulations are much on the old pre-1935 Prussian pattern. It is mentioned that even these are under scrutiny and will be rewritten, to take into consideration the cultural and technical changes of the present. None of the existing safety regulations can or should be considered final.

Regulations for the Examination of Projectionists

The Examination Committee consists of the following members:

Two members of the Dept. of Education, Film Administration branch;

One member of the Labor and Professional Improvement Dept.;

One member of the Police Dept., Fire Division;

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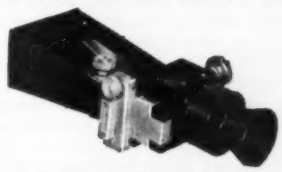

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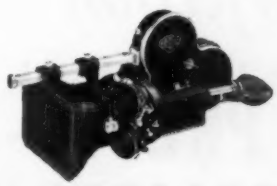

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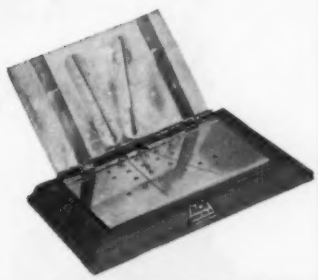

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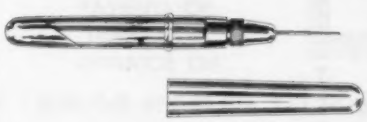

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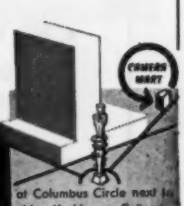

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Subject matters of the examination:

a. Proof of general knowledge in sociology and civilization in relation to politics, especially the sociological and culture political importance of film, and the agitative duties of the projectionist.

b. General knowledge of electrical installations in motion-picture theaters, construction and mode of operation of the most important electrical connections. The knowledge of locating of trouble spots with certainty; the elimination of troubles in electric equipment; general knowledge of sound and light technics, as well as optics; the construction and servicing of the most common projectors and the functions of the components, including portable sound equipment; familiarity with the most important safety, police, fire, plant and workman's protection regulations for projectionists of all kinds; the complete familiarity with the properties of film and with the methods of handling film; the knowledge of all measures to be undertaken in case of fire in motion-picture houses, or during any other film performances.—*E. I. Guttman and F. J. Kolb*, Manufacturing Experiments Div., Kodak Park, Eastman Kodak Co., Rochester 4, N.Y.

Communication Engineering

By W. L. Everitt and G. E. Anner. Published (1956) by McGraw-Hill Book Co., 330 W. 42 St., New York 36. 644 pp. 346 illus. 6 × 9 in. Price $9.00.

This is the latest edition of a book which has enjoyed a long tradition in the field of communications. The earlier editions were by the senior author alone; Mr. Anner has joined in the preparation of the third edition.

As the authors note in a preface, it is a taller order in 1957, than it was in 1932, to put communication engineering into a single volume. Thus although the title is retained because of its reputation, the present volume attempts to cover only basic linear elements (including linear amplifiers and electromechanical devices) with a brief discussion of modulation. The reader needs other information to carry out a real system engineering project.

Specifically, the book, after noting the general nature of signals and modulation, comprises an outline of network analysis and network theorems, from simple networks and resonances through bridge networks, repeated networks, wave filters, to the various wire lines (smooth and with reflections), with impedance transformations and matching. The book continues with a discussion of equalization, an analysis of the linear amplifier, and a description of electromechanical coupling. It closes with an appendix on hyperbolic functions.

A candid appraisal must state that the treatment seems old-fashioned. First there is no need in 1957 to bring up the "mile of standard cable." Further, the older art, because it was largely applied directly to telephony, placed little emphasis on phase, and the book reflects this. It does not even mention the minimum phase concept, announced by Lee and applied so extensively by Bode. It gives a tantalizingly inadequate treatment of feedback, without a word on the stability criterion of Nyquist. The book gives a discussion of amplitude equalization, but only two pages to phase correction, and ignores the masterfully compact delay equalization technique of Nyquist. Noise, considering its paramount position as a parameter in communication engineering, also receives only very incidental treatment.

In spite, however, of these shortcomings, there is really much substance to this book, and the engineer will find it very handy for the understanding of a great deal of his network and signal transmission problems. —*Pierre Mertz*, Bell Telephone Laboratories, 463 West St., New York 14.

Industrial Motion Pictures is a new Kodak booklet primarily designed to give the industrial motion-picture photographer all the information he needs to produce low-cost films on all Kodak 16mm motion-picture films. It is sufficiently basic in its approach to be of use also to the serious amateur in supplying answers to problems concerning procedures and materials in film production.

Beginning with a discussion of the planning and schedule preparation that must precede actual shooting, the booklet reviews the equipment to be used and the procedures for using it, pictorial continuity, lighting techniques, special effects, editing and titling. A brief section on sound recording and reproducing is included, and there is a chapter on the various applications of motion-picture photography in industry, with short descriptions of the techniques involved in such matters as time-lapse, micro-motion analysis, infrared motion pictures and cinephotomicrography.

At the end of the booklet are five pages of complete data on 16mm Kodak films, both black-and-white and color, including exposure and illumination tables and a table of lamp-to-subject distances. The 78-page booklet is available from Kodak dealers for 50 cents.

An International Calendar of Film Festivals, Contests and Awards has been published by the University Film Producers Assn. Issued as an attractive 20-page booklet, the compilation was made by Frank Neusbaum, Administrative Head, Motion Picture and Recording Studio, Pennsylvania State University. It is valuable especially to producers and sponsors. The booklet lists the titles of the various events, the dates, the deadlines for entries, the categories, the procedures for entry, and the names and addresses of the persons

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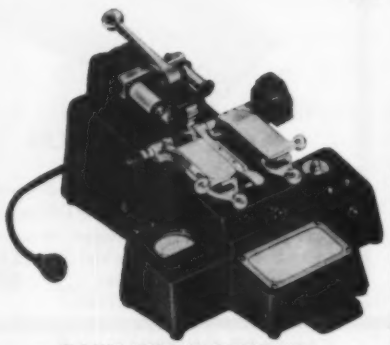
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or organizations to whom to write for further information. Copies are available for $1.00 in the United States and $1.25 elsewhere, from Frank Neusbaum, 112 West College Ave., University Park, Pa.

Artificial-Light Photography by Ansel Adams is published by Morgan & Morgan, Inc., 101 Park Ave., New York 17, and is priced at $3.75. The 128-page book covers eight main sections and contains 55 illustrations. It is fifth in a series by Mr. Adams called the Basic Photo series. Each book explores some aspect of still photography. Titles of earlier books in the series are: *Camera & Lens; The Negative; The Print;* and *Natural Light Photography.*

The American Society for Engineering Education is conducting a study that has a long-range goal of increasing the number of engineering teachers and raising teaching standards. The survey will cover engineering teachers and the faculties of engineering colleges with the purpose of developing information with which to measure quantitatively the need for new engineering teachers. The survey is also expected to make it possible to identify and study the problems of meeting this need and to initiate and encourage activities to increase the supply and quality of engineering teachers. Headquarters of the Society are at the University of Illinois, Urbana, Ill., W. Leighton Collins, Secretary.

current literature

The Editors present for convenient reference a list of articles dealing with subjects cognate to motion-picture engineering published in a number of selected journals. Photostatic or microfilm copies of articles in magazines that are available may be obtained from The Library of Congress, Washington, D.C., or from the New York Public Library, New York, N.Y., at prevailing rates.

American Cinematographer vol. 38, Feb. 1957

Natural Source Set Lighting (p. 86) *C. Loring*

Zoom Effects in Animation (p. 88) *J. Hoke*

Cinemiracle (p. 94) *J. Henry*

vol. 38, Mar. 1957

"Night Passage"—First in New Technirama Large-Screen System (p. 148) *A. Rowan*

Filming "Championship Bowling" for Television (p. 150) *S. C. Goltz*

Tele-Cam—Newest of Video-Film Camera Systems (p. 152) *J. Forbes*

Location Filming "Down Under" (p. 160) *P. Beeson*

British Kinematography vol. 30, Jan. 1957

The Projectomatic System (p. 3) *T. Robinson*

vol. 30, Feb. 1957

A Magnetic Tape Recording System for Colour Television Signals (p. 31) *H. R. L. Lamont*

An Approach to Wide-Angle Motion Picture Photography (p. 43) *R. L. Hoult*

Electronics vol. 30, Mar. 1957

Monochrome Slides Broadcast Color (p. 169) *E. L. Covington*

International Photographer vol. 29, Mar. 1957

Film for Color Kinescope Recording (p. 5) *R. G. Hufford*

International Projectionist vol. 32, Feb. 1957

Screen Illumination: Some Pertinent Facts (p. 10) *A. J. Hatch*

The Historical Controversy of Molteni's Choreutoscope (p. 22) *J. Card*

The Faster Pulldown Geneva Movements (p. 26) *J. M. Ruiz*

vol. 32, Mar. 1957

The Important Optical Train (p. 7) *R. A. Mitchell*

New Italian Projector for Widescreen Presentation (p. 12) *R. G. Fedi*

A Defense of Magnetic Reproduction (p. 22) *J. G. Frayne*

Kino-Technik vol. 11, Jan. 1957

Modernste Atelier Technik in Hamburg: die Studioanlagen der Real-Film GmbH (p. 4)

Feinmechanische Präzision beim Bau von Atelierkameras (p. 7)

Ein Neuartiger Doppelscheinwerfer für das Filmatelier (p. 9) *Neitzel*

Augenschäden durch elektromagnetische Strahlung (p. 10) *H. Schober*

Die Schärfe bei Breitbildprojektion mit Sicherheitsfilm (p. 14) *A. Jotzoff*

Projektion von Werbedias auf breitem Bildschirm (p. 17) *H. Tümmel*

B 11—ein Neuer Bauer-Projektor für Kleinere Theater (p. 19)

Kinematische Eigenschaften des Malteserkreuzgetriebes (p. 20) *R. Böhme*

Aus der Geschichte der Kinematographie (p. 22) *H. Tümmel*

Motion Picture Herald (Better Theatres Section) vol. 206, Mar. 30, 1957

Proper Projection and Anamorphic Lens Combination (p. 24) *G. Gagliardi*

Philips Technical Review vol. 18, Dec. 1956

A Flying-Spot Scanner for Televising 35mm Film (p. 193) *F. H. J. van der Poel*

SMPTE Test Films

Test films planned by the Society's technical committees and produced under the Society's exact supervision are available from the headquarters office at 55 West 42 St., New York 36. Catalogs containing brief descriptions of each film are obtainable on request.

These films are used by manufacturers for testing the performance of new equipment, by television station technicians for lining up and adjusting film pickup systems, by maintenance men for "in service" maintenance of projectors and sound equipment, and by dealers for testing and demonstrating equipment.

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SB-1
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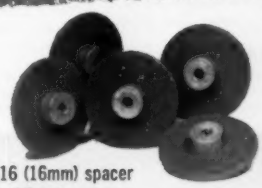
SP-35 (35mm) spacer



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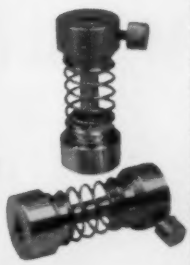

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Magnetic — 16mm Sound Only
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- 400-Cycle Signal-Level Test Film
- 300-Cycle Flutter Test Film

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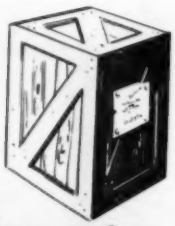
- Multifrequency Test Film
- Scanning-Beam Illumination Test Film
- Buzz-Track Test Film
- Sound-Focusing Test Film
- 400-Cycle Signal-Level Test Film

Picture Only — 16mm
- Registration Test Film
- Travel-Ghost Test Film

Glass Slide — 16mm
- Projector Lens Resolution Target



new products

(and developments)

Further information about these items can be obtained direct from the addresses given. As in the case of technical papers, the Society is not responsible for manufacturers' statements, and publication of these items does not constitute endorsement of the products or services.

New Photographic Process

Kalvar, a new process which works by photographic production of light-scattering centers in its surface structure rather than light-absorbing grains as in conventional systems, eliminates all chemicals and hastens the drying time normally required for development, fixation and washing and drying. The process has been developed by Kalvar Corporation, 909 South Broad Street, New Orleans, La. Shelf-life in storage and image permanence are reported superior to conventional photographic materials. Sensitivity may be measured to permit handling of film and paper in daylight, an important advantage in copying applications. Of great importance is the fact that these films and papers are not sensitive to ionizing radiation. In the event of atomic attack or bomb test fall-out, this photographic system could operate.

Basic elements of the process are Kalvar photographic films and papers which, like conventional processes, have either wide gray scale and tonal range for continuous tone pictures, or high contrast for line-copy or half-tone pictures.

In all photographic applications where high light sensitivity is not prerequisite, Kalvar photographic materials may be used. Outstanding Kalvar applications include copies of original photographs made by conventional processes, microfilm copies, copies of kinescope and motion-picture film, original microfilm records, photographic enlargements, originals and copies of oscillograph records and as the film intermediate between original copy and photo-engravings of lithographic printing plates.

The unique nature of the process requires specialized equipment, much of it now reported as available. This equipment includes microfilm enlargers, microfilm cameras, roll-to-roll printers for microfilm, motion-picture and kinescope film, engineering drawing printers, and devices to copy Navy and Air Force aerial reconnaissance photographs.

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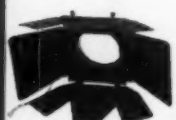
"What I need are barndoors that stay put and C Clamps that really grip a pipe."



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Supermendur

A new magnetic alloy developed at Bell Telephone Laboratories will permit reductions in the size of magnetic components without any sacrifice in performance, and will facilitate the design of new components having greatly improved performance characteristics.

The composition of the alloy, called Supermendur, nominally 49% iron, 49% cobalt and 2% vanadium, is similar to 2V-Permendur, a magnetic alloy developed at Bell Laboratories many years ago. H. L. B. Gould and D. H. Wenny, however, have improved the characteristics so that the hysteresis losses have been reduced by a factor of 10 and maximum permeability is now 66,000 at 20,000 gausses. Remanence is 21,500 gausses; coercive force is 0.26 oersted; and saturation is 24,000 gausses. Core losses are under 6 w/lb at 400 c at a flux density of 100,000 lines/sq in. The hysteresis loop is rectangular with a flux swing of 45,500 gausses from minus remanence to plus saturation.

By using commercial materials of the highest purity, melting in a controlled-atmosphere furnace, and subjecting the resulting alloy to a prescribed schedule of rolling and heat treatment in a magnetic field, Messrs. Gould and Wenny have obtained a material so malleable that it can be cold-rolled from 0.090 in. to 0.0003 in. without intermediate anneals and without losing ductility. Power transformer cores of 0.004 in. or 0.002 in. Supermendur tape can provide an output more than 30% greater than comparable grain-oriented silicon steel cores, the best previously available material. Advantages on an ampere-turn excitation basis achieve even greater percentages. This permits a reduction in core size and weight of at least 30% for the same output, a significant factor in many applications. Flux density can exceed 140,000 lines/sq in. without excessive losses.

Characteristics of this material made it suitable for power transformers, pulse transformers and magnetic amplifiers. The precipitous sides of the hysteresis loop indicate that the gain of a magnetic amplifier can be increased as much as 80% over that obtainable with grain-oriented silicon steel. Other possible applications include telephone-receiver diaphragms, and switching and memory devices. The material is especially useful where miniaturization is desired, or where high-temperature operation is contemplated.

Western Electric Co., Inc., does not plan to produce Supermendur for commercial consumption. A number of companies, however, have expressed an interest in the material and it probably will be manufactured under Western Electric license in the near future.

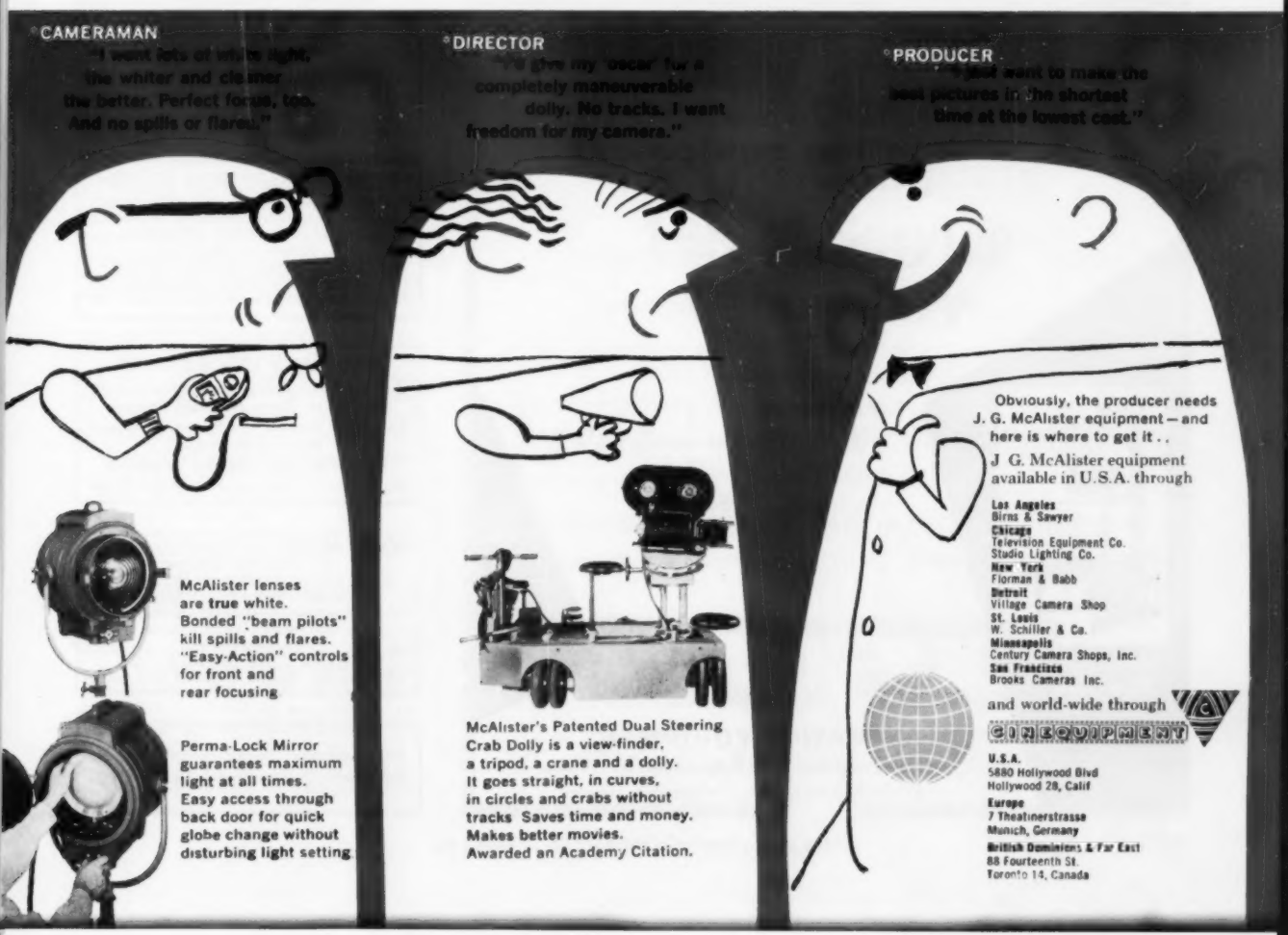
Mass Production of Transistors

"A new technique for the mass production of high-speed and ultra-high-frequency transistors," the *Journal of the Franklin Institute* says in its November 1956 issue, ". . .represents a major advance in semiconductor technology. Two new types of transistors, a Micro-Alloy Transistor (MAT) and a Surface-Barrier Diffused Transistor (SBDT), the direct result of this technique, are now in engineering development.

"Developed at Philco's Research Laboratories," the item continues, "in cooperation with the Navy, Army Signal Corps and the Air Force, the new devices will be produced by the Lansdale Tube Co., a division of Philco, at its new semiconductor plant at Spring City, Pa. The MAT and SBDT may be used in electronic 'brains,' guided missiles, communications, radar, and other military equipments.

"The MAT and SBDT devices are fabricated from the element germanium and utilize Philco's unique Surface Barrier technique. This process, now highly mechanized, permits the mass production of transistors requiring precision control of critical dimensions. It avoids the necessity of manually assembling the germanium and the electrode material and alloying them in a furnace.

"Primarily designed for high-speed electronic computers, the MAT employs a new Philco 'microalloying process' which uses doped semiconductor layers only a few millionths of an inch thick. In conventional alloying, the doped layer must be made relatively thick, and due to the basic nature of the alloying process, is difficult to control. The new device is reported to be at least ten times faster than the fastest vacuum tube in electronic computers.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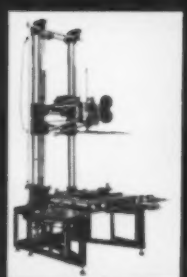

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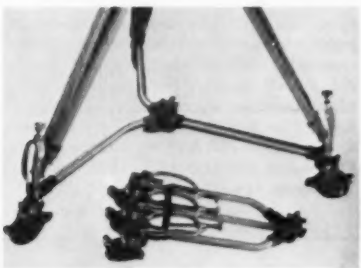
"The other new device, the SBDT, will operate in the ultra-high-frequency range of 500 megacycles. It will find its widest use in the 20 to 200 megacycle range. This transistor, which also utilizes Philco's electrochemical and microalloying techniques, permits the effective use of what is known as 'surface diffusion.' In this particular process, the tiny germanium transistor blanks are subjected to a very carefully controlled 'atmosphere' at high temperatures. This atmosphere contains particles of metal in gaseous form. When properly controlled, atoms of the metal penetrate the surface of the germanium by diffusion. The SBDT technique, using highly mechanized precision etchings, results in transistors having Alpha cutoff frequencies above 600 megacycles.

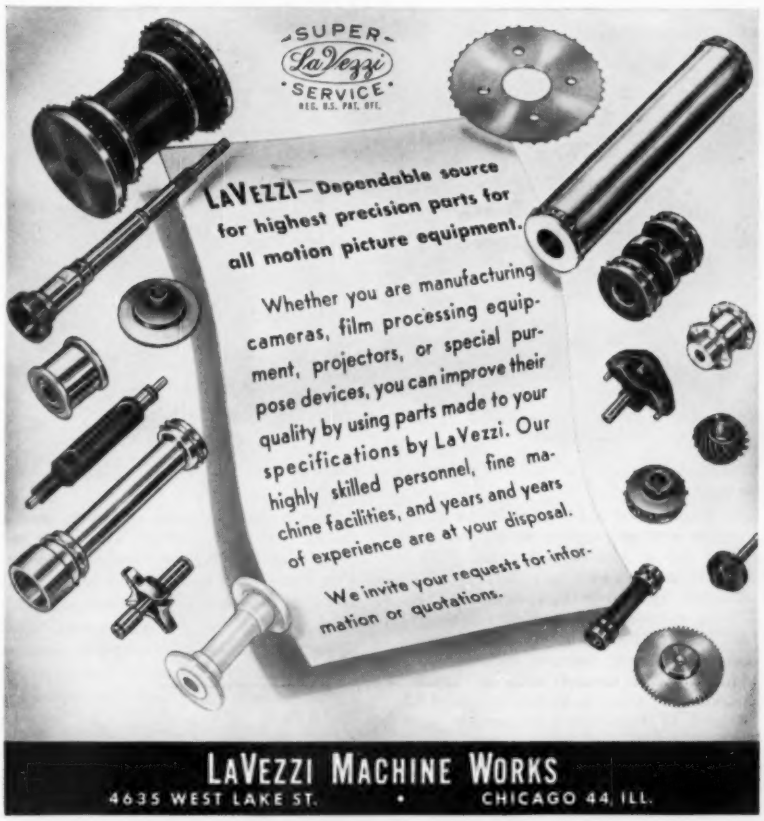
"The new MAT and SBDT semiconductors will join a group of Philco transistors that runs the gamut from milliwatt hearing aid amplifiers to 10 watt power units, in addition to 40 to 80 megacycle Surface Barrier Transistors used in computers, communications and military equipments."



This three-wheel collapsible dolly has also been designed in very light weight and introduced by the Camera Equipment Co., 315 W. 43 St., New York 36. There are two models: the Junior, which weighs 15½ lb; and the Senior, 18 lb. They fold into compact shapes for ease in carrying. Designed for use with any professional or semiprofessional tripod, they are made of high tensile-strength aluminum castings, with chrome-plated tubing, ball bearings and locking rubber-tired casters. The dimensions are: Junior — over-all collapsed size, 8½ in. × 12 in. × 27½ in.; distance between tripod receptacles, open position, 34½ in.; tube diameter, 1 in.; wheel diameter, 4 in.; Senior — over-all collapsed size, 9¼ × 11¼ × 29½ in.; distance between tripod receptacles, open position, 39 in.; tube diameter, 1½ in.; wheel diameter, 5 in.

Price of the Junior dolly is $99.50; the Senior is $150.00

Ampex Corp., Redwood City, Calif., has announced plans for a subsidiary company, Ampex Audio, Inc., which will be located in Sunnyvale, Calif. Beginning about July 1, the new firm will occupy a 40,000 sq ft building. The office will occupy 8000 sq ft and 32,000 sq ft will be occupied by the manufacturing plant. President of the new firm will be Phillip L. Gundy. He is now a Vice-President of the parent corporation and has been serving as Manager of the Audio Division.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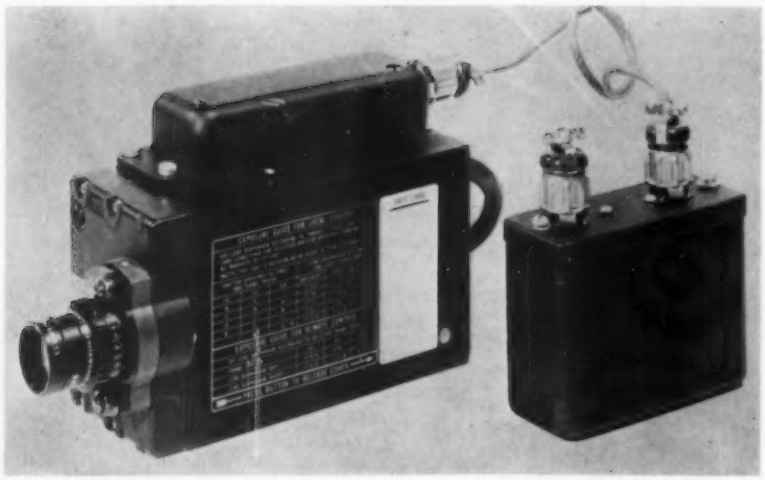

The Traid TN-9 has been made by modifications and adaptations on the standard GSAP Bell & Howell N-9 camera. Basic designs incorporated are Traid TN-9, standard instrumentation design; Traid TN-9A, automatic exposure control design; and Traid TN-9B, pulse-operated interval design. Optional features include automatic exposure control; strip or "streak" operation; conversion to slow speeds of 12, 24 and 48 frames/sec; conversion to a single high speed of 100 frames/sec; conversion for use under loads to 100 g; conversion for use in scope recording; and a timing system, event timer, viewfinder and correlation-output pulse installation. Available accessories include: full range of C and GSAP mount lenses; 100-ft and 50-ft magazines; special camera mounts; boresights; remote controls; and color film as well as black-and-white. A fully detailed and illustrated 8-page brochure describing the features of the Traid TN-9 will be mailed on request by the Traid Corp., 17136 Ventura Blvd., Encino, Calif.

A self-contained, portable photometer, incorporating a highly regulated power supply, is a product of the El Dorado Electronics Co., 1401 Middle Harbor Rd., Oakland 20, Calif. Known as the PH-200 Universal Photomultiplier Photometer, it is reported to be able to use any commercially available photomultiplier or photoelectric tube. Separate zero and dark-current adjustments as well as both decade and continuously variable sensitivity controls increase its flexibility. The instrument is supplied complete and ready for use with tube base, tube holder, interconnecting cables and one Type 931-A Photomultiplier Tube. Dimensions are 10 in. high, 7½ in. wide, and 9 in. deep. It weighs 12 lb.

COLOR TEST FILMS AND SLIDES FOR TELEVISION STATIONS

SMPTE now has available 35mm and 16mm color television test films and slides designed for TV station use under specifications set up by the SMPTE Television Committee—representing the quality of color material obtainable from Ansco, Technicolor and Eastman prints.

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☐ Gray scale at start of first scene can be used in set-up or for adjusting signal generating equipment so that the chrominance subcarrier vanishes with given set-up.

☐ Same high quality picture material in both films and slides.

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RCA's Missile Test Project at Patrick Air Force Base, Florida, now has openings for experienced processing technicians—still and motion picture (both color and black-and-white). Applicants must have experience in automatic processing techniques. Knowledge of Houston-Fearless equipment highly desirable.

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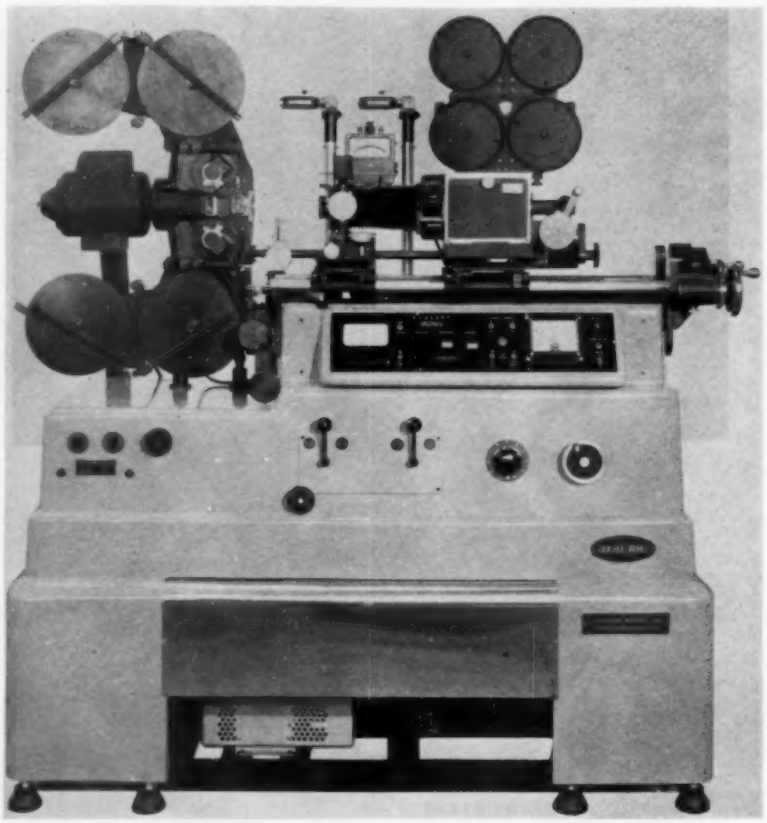


A new optical printer designed by John Oxberry is now available from the Animation Equipment Corp., 38 Hudson St., New Rochelle, N.Y. New features include a superimposure device having a ground glass marked for silent aperture, camera sound aperture, 35mm sound projection aperture, 25% cutoff for 35mm, 16mm projection aperture, horizontal and vertical crosslines common to all rectangles and a short tick for center of silent 35mm; automatic dissolve designed to run forward or in reverse, continuously or in stop-motion, with range from 10 to 120 frames; Oxberry camera adaptable for 35mm or 16mm; achromatic condensing system permitting delivery of 22,000 ft-c with a 500-w bulb; projector head providing for interchangeable shuttles and sprocket assemblies for 35mm or 16mm film, including four spindles for 1000-ft reels; lens mount with dial indicators registering to 5/10,000-ths of an inch.

The printer can handle enlargements up to 4 and reductions down to 5¾. The working space of 30 in. between camera and projector permits use of CinemaScope lenses. Projector head and camera have separate 700-rpm motors which bypass the stop-motion clutch and can thus be changed from designated speed to rewind and back without adjustment. The stop-motion motor operates through a range of 60 to 240 rpm, with speed indicated by an electric tachometer. Camera and lens have separate flip-over counters which designate zoom positions in hundredths of an inch. A vernier dial is also provided which permits readings in thousandths of an inch.

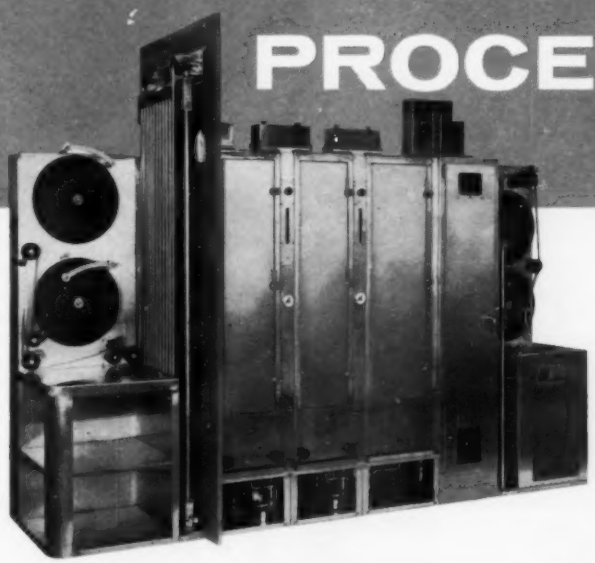
Dallas Film Industries, Inc., is a new company that has just announced its formation at 1011 Mercantile Securities Bldg., Dallas, Tex., for the production of films for television, theaters and industry. The production schedule for 1957 calls for a minimum of 26 half-hour television programs and two feature films for theatrical release. President of the new company is Joe Graham, who was until recently with the American Broadcasting Co., New York.

Three new television video equipment catalogs and a new audio equipment catalog are now available from Radio Corp. of America, Commercial Electronic Products, Camden 2, N.J. The video catalogs consist of a Camera Catalog, with a full line of RCA cameras and mounting accessories for live telecasting; a Film Catalog, with equipment for the film room; and a Terminal Catalog containing video distribution equipment, sync equipment and a full line of microwave gear. These catalogs replace the Video 1 and 2 and the Color Equipment catalog now in use.

The audio equipment catalog has descriptive information and specifications on microphones, turntables, amplifiers and speakers, consoles and rack equipment, and custom equipment.

Chance Brothers Ltd. of Birmingham, Eng., manufacturers of optical, ophthalmic, filter and other types of glass, will henceforth be known as Chance-Pilkington Optical Works, in order to indicate its relationship with its parent company, Pilkington Brothers Ltd. Chance-Pilkington Opti-

RAPID 16/35MM SPRAY PROCESSOR



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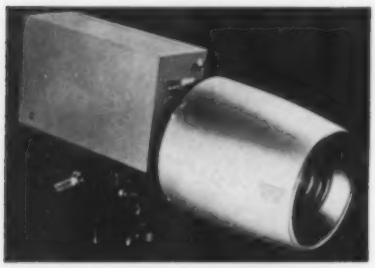
tionship with its parent company, Pilkington Brothers Ltd. Chance-Pilkington Opti-

cal Works is represented in the U.S. by Alfa American Corp., 303 W. 42 St., New York 36; and 5420 Walker Ave., Rockford, Ill.

Two new projector carbon sizes for the latest high-powered reflector lamps are available from National Carbon Co., Div. of Union Carbide Corp. The 13.6mm high intensity "National" projector carbon is now available in 18- and 20-in. lengths, in addition to the standard 22-in. carbon. A new $\frac{7}{16} \times$ 9-in. special "Orotip" cored negative carbon has been developed for use with these two new positive carbons.



A new model of the Auto-Zoom variable focal length lens for small television cameras has been announced by Perkin-Elmer Corp., Norwalk, Conn. The new lens has a speed of $f/3.5$, more than twice as fast as its $f/4.7$ predecessor. The lens has a 5:1 (30–150mm, 60–300mm) variable focal length range. Improvements have been made in the electrical and control system permitting it to be remotely controlled 4000 ft away from the camera. Series 7 accessories can also be mounted on the improved lens. The lens has been designed for use with 16mm and vidicon-tube TV cameras. The dimensions, including motors but not control box, are $8\frac{1}{2}$ in. long $\times$ $6\frac{1}{2}$ in. in diameter. It weighs about 6 lb. The lenses are priced at $1,350 for the motorized iris model and $1,200 for the manually operated iris version.

A new line of spool-loading 16mm cameras in medium-price range has been announced by Bell & Howell Co., 7100 McCormick Rd., Chicago 45. Known as the 240 series, the cameras are available in single-lens and two- and three-lens turret versions, featuring automatic threading, a 32-ft film run and five camera speeds. Suggested retail prices range from $179.95 to $259.95 and up, depending on choice of lens.

Color photography, both still and motion pictures, will be the main theme of Camera 57, the first Swedish International Photo and Cine Exhibition, scheduled for June 8–16 in the Grand Fair Building, Gothenburg, Sweden. The exhibit is sponsored by the National Union of Photographic Dealers, the Press Photographers Club of Gothenburg, Photo Clubs of Sweden, Swedish Photographers Association and the Swedish Industries Fair. Exhibitors from more than 10 countries are expected to participate.

Supplement No. 2 to the Bibliography of Colour Television, published by the Television Society of Great Britain, 164 Shaftesbury Ave., London, W.C.2, contains 234 items and was compiled by Mrs. K. Bourton of Ultra Electric Ltd. Copies of original Bibliography and of Supplement No. 1 are available at 2/6d each.

A missile-scoring camera "pod" for determining how and why a guided missile hits or misses its aerial target is being manufactured by Bell & Howell Co., 7100 McCormick Rd., Chicago 45, under a U.S. Navy Contract.

Since missile and target both fly at velocities approaching the speed of sound and at altitudes far beyond the range of human vision, a remote control system of recording data is a vital tool in evaluating missile accuracy.

Mounted on the wing-tips of a drone target (a pilotless plane or a larger missile), each missile-scoring pod contains four 16mm high-speed cameras. The eight cameras — four to a pod, with one pod on each wing-tip — are mounted to give complete spherical coverage of a missile's flight as it nears the moving target. The cameras are so aimed that the approaching missile is continuously covered by at least two cameras.

Actual scoring of missile behavior is done by assessing the film records against suitable grid coordinate charts. Data thus obtained show the missile trajectory, miss-distances and other functional characteristics. A built-in electronic timing

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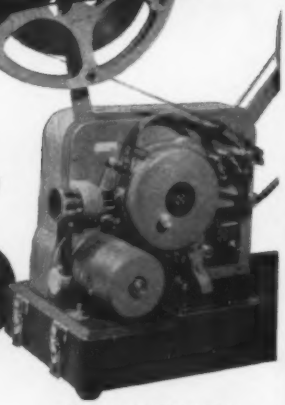

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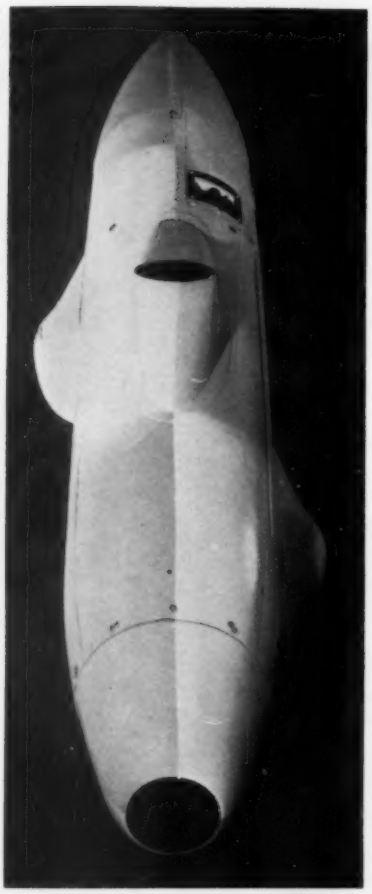
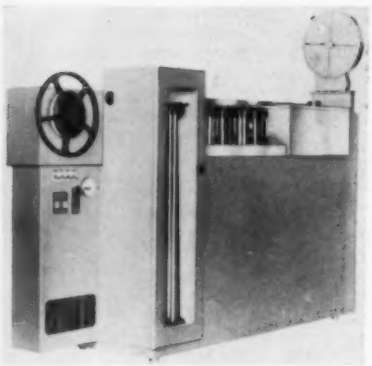


device indicates elapsed time in fractions of seconds on the film so that a missile's path and speed may be accurately evaluated.

The pod is 70¾ in. long with a diameter of 11 in. and weighs 95 lb. The four electrically driven cameras with an operating voltage range of 24–29 d-c have a 200-ft film capacity and are watertight and interchangeable. The lens is 142° wide-angle and the operating range is between 5000 and 50,000 ft at velocities up to Mach 0.95 (just short of the sound barrier).

If there is a direct hit, the pods are jettisoned without damage by means of an explosive bolt, or "squib." Once free of the drone, the pods are lowered to earth by means of self-contained 16-ft parachutes, which land them in a position calculated to minimize impact damage. For recovery from water, they have nonmechanical flotation gear which keeps them surfaced for 24 hr; built-in dye markers; and an exterior finish in standard government recovery colors of brilliant yellow-and-red to assist in their location. To minimize hazard to operating personnel, the pod's explosive jettisoning squib is disconnected electrically until the drone is airborne.

Production quantities of the pod are being delivered to the Navy and are available to companies working on missile-scoring or rocket-scoring systems.



Filmline Corp., Erna St., Milford, Conn., has announced an automatic, temperature-controlled 16mm film processor. The new model, RI5TC, is a modification of the firm's reversal model which is used for developing high-speed microfilm as well as conventional motion-picture film. Among other features the new model has a variable-speed drive mechanism; daylight operation for all emulsions; recirculation pump for developer tank; feed-in elevator and a 1200-ft magazine to permit continuous processing. Dimensions are: height, 50 in.; length, 76 in.; width, 24 in.; weight, 500 lb.

employment service

These notices are published for the service of the membership and the field. They are inserted three months, at no charge to the member. The Society's address cannot be used for replies.

Positions Wanted

Cameraman. College graduate with B.S. in cinema seeks position as cameraman or assistant cameraman with active motion-picture production group. Presently working with small industrial film outfit as assistant cameraman, film editor and sound recordist. Age 25, married, one child. Resume on request. Write: J. B. E., 139 Constant Ave., Staten Island 14, N. Y.

Motion-Picture and Television Production. Twenty years experience in film and 9 years in television, in all phases of work. Desires position with active organization in motion-picture or television production. Not afraid of hard work, heavy responsibility or any problem that may come up in the industry. Available immediately. Write to: Apartment 601, 137 West 45 St., New York, N.Y., Tel: JUdson 2-2257, Ext. 601.

Recording Engineer. Eight years experience in all phases of motion-picture sound recording including operation (as recordist and mixer), research, design and development work, transmission, maintenance and installation. Former assistant to chief recording engineer of major east

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coast studio. Will relocate. Box 26, Oakland Gardens Station, Flushing, N.Y.

Producer-Director-Cinematographer. Comprehensive background in all phases of motion-picture production: creative, technical and artistic. More than 13 years in motion-picture, live-television and radio production. Independent producer 6 years. Experience also includes writing, editing, acting and narration. Very fluent Spanish including technical terms. Desires position with production company or in motion-picture department of large industrial corporation. Interested in the United States, Central or South America. Résumé available in English or Spanish. Write: Oliver E. Cain, P.O. Box 1594, Amarillo, Texas.

Film Writer-Editor, with directorial experience, now engaged in post-graduate work at City College Institute of Film Techniques. Three years experience in direction of off-Broadway theater. Has written scripts for NBC-TV and industrial films. Experienced with all 16mm cameras and editing equipment. Formerly with Screen Gems, Inc. Willing to relocate. Write: Lawrence G. Cohen, 55 Nagle Ave., New York 40.

Summer Job. Third-year student in Photographic Science, Rochester Inst. of Technology. Secy-Treas. SMPTE Student Chapter. Interested primarily in color control and processing, studied color and black-and-white sensitometry, color printing and color studio, photographic technical analysis. Desires lab work during summer in New York City; available June 3. Write: Stan Feigenbaum, 140 Spring St., Rochester 8, N.Y.

Asst. Film Editor. Seeks position in N. Y. area. Will graduate from CCNY in June, completing courses of Inst. of Film Techniques. Currently working 20 hr a week on a major Institute project. Experienced with all cutting room apparatus. Chairman of CCNY Chapter, SMPTE. Morton Schwartz, 1997 Huges Ave., Bronx 57, N. Y.

Cinematographer—Art Director. Graduate university-level motion-picture photography and art-directing course, Academy of Arts, Holland, 1945–50. Over 3 yr experience in planning and production of TV film presentations and film commercials, incl. writing, direction and coordination. Presently employed as assistant film director and set designer. Speaks French, German, Dutch and English. Desires contact with organization active in film production. Excellent references in U.S., Canada and Europe. Resume on request. G. Van Duyn, Wingham, Ont., Canada.

Positions Available

Engineering Director. Top-level engineer required for long-established motion-picture equipment manufacturing concern. Must have long experience with automatic printers, additive and subtractive, and with developing machines; able to discuss equipment problems with customers and explain and demonstrate the company's equipment. Send resume, with references, to: E.M.B.Y., Apt. 1908, 253 West 72 st., New York, N.Y.

Service Engineer, with good mechanical ability and experience in field of motion-picture lab equipment, automatic printers and developing machines. Write: E.M.B.Y., Apt. 1908, 253 West 72 St., New York, N.Y.

Motion-Picture Development Engineer. Mechanical engineer or equivalent required by long-established motion-picture developing concern. Must be thoroughly familiar with machine design and construction and capable of supervising projects through manufacturing processes. Technical knowledge of color and spray processes desirable. Salary open. Send resume with references and salary requirements to: Filmline Corp., 43 Erna Ave., Milford, Conn.

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Meeting Calendar

Armed Forces Communications and Electronics Association, May 20–22, Sheraton-Park Hotel, Washington, D. C.

American Society of Mechanical Engineers, Design Engineering Conference, May 20–23, Coliseum, New York.

Radio Parts and Electronics Equipment Shows, May 20–23, Conrad Hilton Hotel, Chicago.

American Institute of Chemists, May 22–24, Sheraton-Mayflower Hotel, Akron, Ohio.

Acoustical Society of America, May 23–25, New York.

American Rocket Society, Semiannual Meeting, June 9–13, Hotel St. Francis, San Francisco.

American Society for Testing Materials, June 16–21, Chalfonte-Haddon Hall, Atlantic City, N. J.

Professional Group on Electronics, I. R. E., National Convention on Military Electronics, June 17–19, Sheraton-Park Hotel, Washington, D. C.

American Institute of Electrical Engineers, Summer General Meeting, June 24–28, Montreal, Que.

British I. R. E., June 27–July 1, Cambridge University, England.

International Symposium on Physical Problems of Color Television, sponsored by International Union of Pure and Applied Physics, French Physical Society, French Society of Radioelectricians, French Society of Vacuum Engineers, July 2–6, National Conservatory of Arts and Crafts, 292 rue Saint-Martin, Paris 3e, France.

Western Electronic Show and Convention, Aug. 20–23, Cow Palace, San Francisco.

Biological Photographic Association, Aug. 27–30, Kahler Hotel, Rochester, Minn.

82nd Semiannual Convention of the SMPTE, including Equipment Exhibit, Oct. 4–9, Philadelphia-Sheraton, Philadelphia.

National Electronics Conference, Oct. 7–9, Hotel Sherman, Chicago.

American Standards Association, Eighth National Conference on Standards, Nov. 13–15, San Francisco.

83rd Semiannual Convention of the SMPTE, including Equipment Exhibit, April 21–26, 1958, Ambassador Hotel, Los Angeles.

84th Semiannual Convention of the SMPTE, Oct. 20–24, 1958, Sheraton-Cadillac, Detroit.

American Standards Association, Ninth National Conference on Standards, Nov. 18–20, 1958, Hotel Roosevelt, New York.

85th Semiannual Convention of the SMPTE, including International Equipment Exhibit, May 4–8, 1959, Fontainebleau, Miami Beach.

86th Semiannual Convention of the SMPTE, including Equipment Exhibit, Oct. 6–10, 1959, Statler, New York.

SMPTE Officers and Committees: The rosters of the Officers of the Society: its Sections Subsections and Chapters, and of the Committee Chairmen and Members were published in the April 1957 Journal.

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